PUBLICATION OFFICES:

168-177 POTTER BUILDING, NEW YORK.

Telephone Call: Murray 586. Cable Address: "Electrical," New York.

W. J. JOHNSTON, Editor and Publisher.

T. COMMERFORD MARTIN, JOSEPH WETZLER, } Associate Editors.

WM. A. ROSENBAUM, Asso. Editor Patent Department.
CLARENCE E. STUMP, Business Manager.
WALTER T. HUNT, Advertising Dept.

New England Office, 178 Devonshire Street, Boston.
W. I. BARKER, Manager.

Western Office, 44 Lakeside Building, Chicago.
E. L. POWERS, Manager.

SUBSCRIPTION, IN ADVANCE, ONE YEAR, $3.

(Including Postage in the U. S. or Canada.)

IN CLUBS of 4 or more the rate is $2.50 a year each; with a free extra copy to the getter up of a club of 8. Subscription to foreign countries, $5 a year.

In requesting your address changed, give **old** *as well as new address.*

ESTABLISHED **FOURTEEN** YEARS AGO,

THE ELECTRICAL WORLD

IS THE PIONEER WEEKLY ELECTRICAL JOURNAL OF AMERICA, AND HAS WELL MAINTAINED ITS LEAD.

IT HAS THE LARGEST CIRCULATION

OF ANY ELECTRICAL PERIODICAL IN THE WORLD, AND IS

THE BEST ADVERTISING MEDIUM.

Advertising Rates are much lower than those of any other similar publication, circulation and standing considered, and vary according to space, position and number of insertions. Quotations promptly furnished on application covering these points.
For Sale Notices, Situations or Help Wanted, $1 to $2 an issue.
Matter for the **Editorial** Department should be addressed to

The Editor of The Electrical World, New York.

Subscriptions and communications relating to **Advertising** or the **Business Department** should be addressed to

W. J. JOHNSTON, Publisher,

Potter Building, New York,

OR EITHER OF THE BRANCH OFFICES.

"THE ELECTRICIAN" IN THE UNITED STATES AND "THE ELECTRICAL WORLD" IN THE UNITED KINGDOM.

Arrangements have been made by which the London "Electrician" can be obtained from THE ELECTRICAL WORLD *office,* 168-177 *Potter Building, New York.*

The rate of subscription (payable in advance), including postage, is $6 *per annum to any address in the United States, Canada, Mexico or other foreign country.*

Single copies, price 10 *cents, can also be obtained at* THE ELECTRICAL WORLD *office. Similarly* THE ELECTRICAL WORLD *can be obtained in England at the office of* The Electrician, 1 *Salisbury Court, Fleet Street, London, E. C.*

The rate for English or foreign subscribers (payable in advance) £1. 1s.

VOL. XII. NEW YORK, NOV. 3, 1888. No. 18.

CONTENTS.

ILLUSTRATED ARTICLES: PAGE.

Mechanical Regulation of Dynamos ... 238
The Brush Lighting Plant for the Man-of-war "Boston" ... 238
A Curious Light Effect in Incandescent Lamps ... 239
Otto Gas Engine and Dynamo Combined ... 238
The Baxter Motor at the Julien Station, New York ... 239
The Electromotive Properties of the Human Heart ... 240
The Waterhouse Arc Lamp ... 241
Uptown Edison Station, New York ... 241
A Model Westinghouse Central Station ... 242
Eddy's Electric Measuring Instrument ... 243
The Baxter Gravity Drop ... 243
Combination Floor Key and Movable Table Button ... 243
Thomson's Electric Welding Apparatus ... 243
On the Voltametric Measurement of Alternating Currents ... 244

EDITORIAL:

Paragraphs ... 237

MISCELLANEOUS.

Meeting of the New York Electrical Society at the Edison Laboratory ... 238
Notes on Some New Sprague Roads ... 239

MISCELLANEOUS: PAGE.

Flexible Hard Rubber Insulation ... 239
Universality of Vibration ... 241
Electric Lighting in Mines ... 242
New York Steam Pipes and Electrical Subways ... 242
Alternate Current Electrolysis ... 242
A Statue to Ampère ... 243
Telephone Statistics ... 243
An Accumulator Locomotive ... 243
Voltametric Control of Ammeters ... 243
Aiding the Jacksonville Telegraphers ... 244

SPECIAL CORRESPONDENCE:

New York Notes ... 244
New England Notes ... 245
Philadelphia Notes ... 245
Western Notes ... 245
Canadian Notes ... 246
English Notes ... 246

DEPARTMENTS:

The Telegraph ... 246
The Telephone ... 247
The Electric Light ... 247
Applications of Power ... 247
Personals ... 247
Miscellaneous Notes ... 247
Business Notices ... 248
Our Illustrated Record of Electrical Patents ... 248

The Handy Electric Motor. OUR columns present this week, in the article on the Baxter motor at the Julien station of the Fourth Avenue Railway, a very interesting example of the advantages which electric power offers, even in a place where steam is being directly generated and used. In order to economize space, the work-shop has been mounted on a platform, suspended from the ceiling above, and here the motor is found to be the handiest piece of power-transmitting mechanism that could possibly be asked for or devised. Although the steam engine running the dynamo that furnishes current is only a yard or two away, it is found advantageous to take its power with the intervention of the snug little motor.

Dynamo Regulation. OF the various methods of magnetic regulation of dynamos, the one in which the strength of the magnetic field is varied by the removal of the magnets from the armature has perhaps received the least amount of attention. Our columns have, at various times, contained descriptions of such a method; and this week we give another plan in which that principle is applied. It is apparently a very simple one, but is open to the objection that the distortion of the field caused by the withdrawal of the cores of the magnet might require the readjustment of the brushes in order to prevent sparking at the commutator.

Glowworm Phenomena. RECENT articles on the subject of the improvements to be looked for in the manufacture of light have pointed in the direction of a light which should approximate more nearly to that of the glowworm; that is, light which is given out without the usual accompaniment of heat. This, evidently, set some people thinking and experimenting, and we print this week a communication on the subject which is of considerable interest. What the exact cause of the phenomena is it appears difficult to state at present, without knowing fuller particulars than those cited; but on the face of it, it seems to be the well-known electrified vacuum effect, which has frequently been noticed in our columns. Whether the employment of alternating currents tends to increase this effect is the point here. Our correspondent, unfortunately, does not give the E. M. F. of the current passing in the circuit, from which some idea could be formed of the nature of the phenomena. It is sufficiently interesting, however, to warrant further investigation, and we shall probably hear more of it.

Alternating Current Electrolysis. SINCE the publication, a few months ago, of the experiments of Messrs. Manœuvrier and Chappuis on the electrolysis of alternating currents, several others have taken up this question, and attention has already been drawn to previous work in this department, notably that by Sir William Thomson, who, many years ago, demonstrated mathematically that such electrolysis was not contrary to known laws. We give this week in our columns the results obtained in experiments undertaken at the Edison laboratory by Mr. Arthur E. Kennelly, which show not only that such electrolysis is possible but that under proper conditions the indications are commensurate with the accuracy to be obtained with continuous currents, and that we are thus on the point of obtaining a method by which alternating currents can be measured with extreme simplicity and accuracy. One of the most remarkable points brought out in Mr. Kennelly's article is that the voltameter, notwithstanding the very small surface exposed by the electrodes, offers but a very small resistance, far smaller, indeed, than would be the case if continuous current were employed of the same strength.

Electric Light Customers. THE pamphlet just published by the Westinghouse Electric Company is striking not only for the beauty and sumptuousness of its get up and illustrations, but for the manner in which it discusses many of the topics in the field of electric lighting as a business and industry. We do not refer so much to its explanation of the alternating current system, though that is the best piece of popular work done in that line up to date, but to the hints on exploiting the light and securing customers for it. As to the probable market in any locality, it is stated that other conditions being reasonably favorable, incandescent lighting can compete with gas, even when no meter is used, so long as coal does not cost per ton more than twice as much as gas per thousand feet. Of course, with a meter, the electric light company stands a much better chance of good dividends, and we would certainly advise that a meter be put in wherever possible. As to the extent of the market, it is further stated that the initial canvass of an ordinary town yields patronage to the extent of about one lamp to every eight inhabitants. This gives a basis for the original installation. These statements are very helpful in bringing the subject down to figures about which every electric lighting man has special information or an opinion of his own. We may venture to express our personal belief that where the incandescent service is satisfactory, the price of gas is not so direct or serious a matter in the competition as has been argued. In every community there will be a large number of persons anxious to get the purer and cleaner light, and with these as a nucleus of support, the light works its way steadily into general favor.

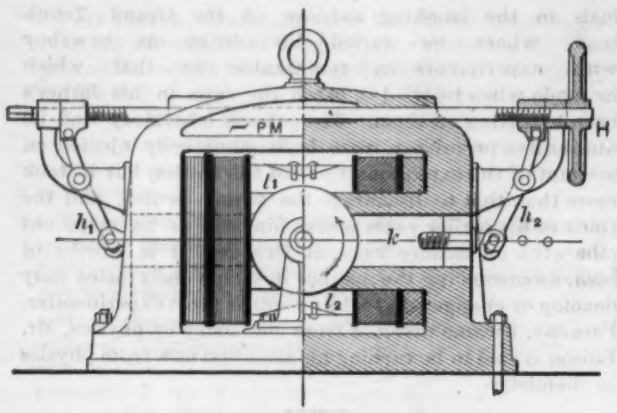
The Edison Laboratory. THE visit paid by the New York Electrical Society last week to the Edison Laboratory to hear Mr. Kennelly's lecture, was no only an interesting event in itself, but offered one or two suggestions and reminders. Such a place must inevitably impress upon every one who sees it the fact that electricity is rapidly passing away from what may be called the "romance" period, the age of myth and marvel, and entering upon that which belongs to the better and higher evolution when the electrician "proves all things," and applies to each new idea or machine the test of scientific investigation and measurement. It is not the least of the advances to Mr. Edison's credit that he has been so prompt to devote his hardwon wealth and leisure to such a laboratory, whose very existence is a sign of the new era. Perhaps the other night his thoughts went back, as did those of some at the meeting, to the days of his first laboratory, the little collection of chemicals in the smoking caboose on the Grand Trunk road, where he varied his duties as newsboy with experiments as remarkable as that which he made when he tried to hatch the eggs in his father's barn by sitting on them. The caboose laboratory and its diminutive proprietor were both summarily ejected on account of the explosion of one of the bottles, but it took more than that to discourage the young genius, and the spirit of his earlier years marks him still as he maps out new work on broader lines at Orange. It is worthy of note, as instancing the manner in which one's tastes may develop or change, that while another great experimenter, Faraday, became diverted from chemistry by physics, Mr. Edison is said to be turning his attention now from physics to chemistry.

Naming Electrical Systems. DURING the late discussion of Mr. Sprague's paper, one of the speakers digressed to touch upon the question whether systems which bear similarity to older work ought to be recognized by the names of their designers, or whether they should be known under the generic term of the primary inventors. The question is one that is open to a good deal of argument. To those who are constantly averring that there is nothing new under the sun, the designation of a set of apparatus by the name of its present designer is abhorrent; but we think that when properly investigated, it will be found that in the majority of cases the inventors have an unquestionable right to call their systems by their own names. It is rarely that one man copies absolutely every detail to be found in the work of another, and even if there be little originality in his work, the combination of old materials made by him may be such as to give very different and much better results. If to this we add improvements in detail on all the forms of apparatus of whatever nature they be, it must be conceded that inventors have, in the majority of instances, the rights which they exercise in the naming of their appliances and machines. The analogy drawn by one of the speakers to the practice prevailing among steam engine builders of naming their engines for themselves is a good one. Besides the great distinctive classes of engines, due to the invention of a few individuals, there are a large number of modifications, chiefly in details of construction, which, however, are of such a nature that for their proper distinction by the community at large, it is convenient, as well as proper, to designate by the names of their builders. Just so is it in the case of electrical apparatus, where the designation of the system by name will convey at once to the mind all the peculiarities of construction and practice embodied in that system, and which distinguish it from others of the same class.

Confessing by Telephone. FROM time to time one may notice events that bring out, with unusual force and clearness, the fact that great inventions are chief among the conditions that shape modern life. This is recognized in regard to civilizing elements with which people have long been familiar, such as the railroad and the telegraph, but is not so commonly accepted with respect to an innovation like the telephone. Yet that little instrument is most remarkable for the new relations into which it brings men and their affairs, and it incessantly calls for novel adjustments of our ideas and actions. The legality of contracts by telephone has been an issue for the courts, and but recently we mentioned a case in which a defendant submitted himself for judgment by telephone and received sentence in the same way. More lately again the point has arisen whether gambling carried on by telephone can be lawfully and effectively stopped. In medicine, numerous instances have occurred wherein it is unnecessary for the doctor to see his patient, the prescription or advice being such as the telephone shows to be desirable. And now the Catholic church is troubled to decide as to the efficacy of a confession by telephone. The question has been referred to Rome by the French bishops, and among the Italian priests also the subject is an unsettled one. Some authorities hold that the telephone can be used for censure but not for absolution, while others consider that as the telephone annihilates distance, the confessor and the penitent are actually together. Evidently the question goes far deeper than the disputes of mere casuistry, and touches all that serves to surround a solemn act with sentiments of awe. And how solemn itself, after all, is the thought that the telephone is thus among the instrumentalities that release us from the clogs and bonds of physical sense and lift us to a realm where mind and soul, as if clarified and disembodied, can have freest communion.

Mechanical Regulation of Dynamos.

A large number of methods for regulating dynamos are already in existence, but inventive minds are still at work, if not to devise new methods, at least to effect re-arrangement or modification of the old. Our readers are probably familiar with the ingenious method of regulation proposed by Mr. Phillip Diehl, as embodied in his motor, described a few years ago in these columns. In this machine, it will be remembered, the regulation was effected by withdrawing the poles of the magnet from the armature, and thus weakening the field when it is desired to regulate. This idea



THE MULLER DYNAMO.

seems also to have later on been adopted, in slightly different form, by Moehring, who removed the magnet from the armature by a parallel sliding motion. Recently attention has again been brought to this method of regulation by a machine described in the *Centralblatt fur Elektrotechnik* by the inventor, Paul Mueller. As will be seen from our illustration, the machine is of a type which is already well known; but instead of the magnet cores being a solid mass, they consist of tubes within which slide the cores k k of solid iron, which completely fill the tubes. These cores can be withdrawn by means of levers h^1 h^2, connected by a hindwheel H and screw, so that the magnetic field can be weakened or strengthened by inserting or withdrawing the cores k. It goes without saying that the regulation may be effected automatically, and the inventor lays special stress upon the value of the machine as a motor, as it has the advantage of doing away with resistances which consume power. Comparisons of this machine with others would seem to indicate that it possesses some advantages over the usual form.

The Brush Lighting Plant for the Man-of-War "Boston."

Considerable attention has of late been given in this country to the subject of electric lighting plants for ships, the chief reason being, probably, the demand which has arisen for such plants in connection with our new navy. Attention was more specially directed to the subject lately by the work issued from the office of Naval Intelligence at Washington, which included an admirable discussion of the subject by Lieut. J. B. Murdock. We have ourselves from time to time illustrated a number of these ship plants, and now take pleasure in illustrating that which has been recently installed by the Brush Electric Company, of Cleveland, on board the U. S. S. "Boston." Our illustration is so clear as to call for little explanation. The engine is an Armington & Sims new type, double cylinder, 7 × 5, running 450 revolutions per minute, capable of working up to 86.5 h. p. at 80 pounds steam pressure, cutting off at ¼ stroke. The dynamo runs at 1,175 to 1,200 revolutions. It is a Brush compound-wound machine of the latest type and capable of operating 150 lamps of 16 c. p. This ship has been wired for 225 lights, which have been distributed in all parts. The plant includes some very ingenious fittings, in the shape of water and fire-proof cut-out boxes and double pole switches. The "Boston" is also provided with a search light. This plant, which is practically a renovation, the "Boston" having had a plant in use for some time already, was installed for the Brush Company by Mr. C. W. Phipps and Mr. E. Stark, of the New York office. So far, we believe, the method of operating ship dynamos by cog-gearing has not been used very extensively, and the results obtained in this case will be watched with interest. It may be mentioned that the teeth of the gearing are cut out of rawhide.

A Curious Light Effect in Incandescent Lamps.

BY F. J. CROUCH, EUGENE CITY, ORE.

I would like to bring to the attention of the readers of THE ELECTRICAL WORLD the phenomenon presented by an experiment which I have recently made and upon which I would like to hear the opinion of others. The accompanying sketch shows the arrangement by which a peculiar light is furnished by the electric current, which light seems to be similar to that of the glow-worm or fire-fly. With three Bernstein lamps I obtained a beautiful moonlight effect, sufficient to read by in a large room.

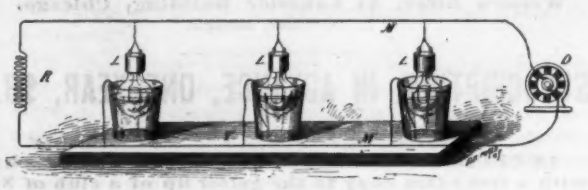
By reference to the sketch one may at a glance see how it is produced. *M M* are the main wires to and from an alternating dynamo *D*. From one side of the circuit are hung the lamps, both poles of each lamp being connected together. At the end of this wire is a resistance coil *R*. of about 2,000 ohms (or a resistance offered by 80 Bernstein lamps in series), which connects one side of the circuit to the other, which leads to the opposite pole of the dynamo.

Each lamp is placed within a tumbler filled with a strong brine (of common salt), thus partially immersing each lamp. From the bottom of each tumbler a copper wire reaches over the rim and is then connected to the return wire, as shown. Now when the dynamo is started the light appears, and the light waves pass through the glass. Is this due to leakage, or is it due to a static electric effect? I should be glad to know if this experiment has ever been tried before and to hear the opinions of others as to the cause of the phenomenon.

Meeting of the New York Electrical Society at the Edison Laboratory.

The first of this season's meetings of the New York Electrical Society, the Electrical Section of the American Institute, was held on Oct. 24 in the lecture hall of the Edison Laboratory at Orange, N. J., on the invitation of Mr. Thomas A. Edison. Over 250 persons were present to hear the lecture on "Electrical Measurement" given by Mr. Arthur E. Kennelly, of the Laboratory.

The lecturer introduced his subject by drawing attention to the fact that all our measurements of whatever sort are based upon certain standards, among which are those of length, mass, time, etc. From these the centimetre-gramme-second system of units had been built up, and had supplied the basis of our modern system and standards of electrical measurements. Beginning with the unit of resistance, Mr. Kennelly discussed the general properties of conductors, the relations which different metals bear to each other, the variations due to temperature and other causes, the peculiarities due to carbon, etc., and showed by actual examples how the various resistances are measured in practice by means of the Wheatstone bridge. He also exhibited a standard ohm and a pencil mark, drawn across a sheet of paper, which represented a resistance of 5,000,000 ohms. Mr. Kennelly next took up the measurement of the electric current, both in the methods of indicating its strength, as well as in registering the quantity of current passing in a conductor during a given time. Mr. Kennelly showed how the practical unit of current was $\frac{1}{10}$ the absolute, and how it was derived and theoretically defined. Among the instruments exhibited for determining current, there

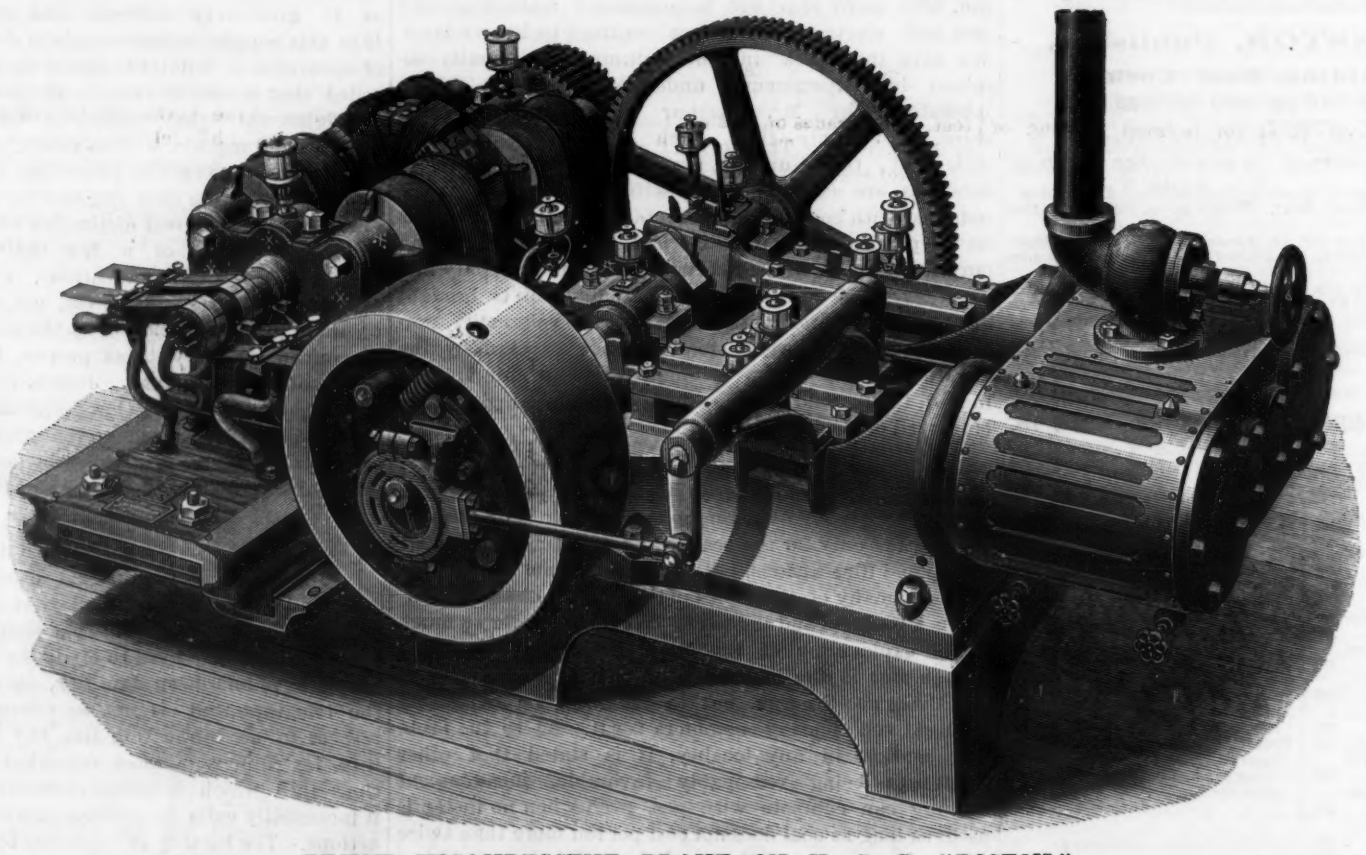


A CURIOUS "GLOW WORM" EFFECT.

were shown the tangent galvanometer, the Edison meter, the solenoid ammeter and several others. Mr. Kennelly, in the same way, passed in review the methods for the derivation of the standards of electromotive force, showing and explaining the various standards, such as the standard Clark cell, and also showing how this unit could be derived from the others. He exhibited the various instruments used for determining the E. M. F. The standards of capacity and methods of determination were next taken up by Mr. Kennelly, and his lecture was concluded by a short résumé of methods for measuring the total amount of energy passing through a circuit. As an example of this there was exhibited an Ayrton & Perry ergmeter, which takes into account in its registration both the current in and the electromotive force of the circuit.

Mr. Kennelly instanced a great many examples during the course of his remarks, and expressed his opinion as to the futility of trying to obtain extraordinary fineness in measurement for practical work, where an error of one or two per cent. was of little consequence as a rule. This criticism, however, did not apply to work in the laboratory, where the finest degree of accuracy attainable should be attempted, but with due regard to the probable range of error. Mr. Kennelly fittingly closed his remarks by alluding to the fact that physical measurement in general had done more to advance our knowledge than almost any other branch of science, and that it will continue to occupy a prominent position, bidding fair to open up many new paths in the future.

At the conclusion of Mr. Kennelly's lecture, Dr. Wangemann, of the Edison Laboratory, gave a brief explanation of the construction and operation of the new Edison phonograph, and favored the audience with several musical and rhetorical selections. Among the latter was a reproduction of the crying of Mr. Edison's baby, which con-

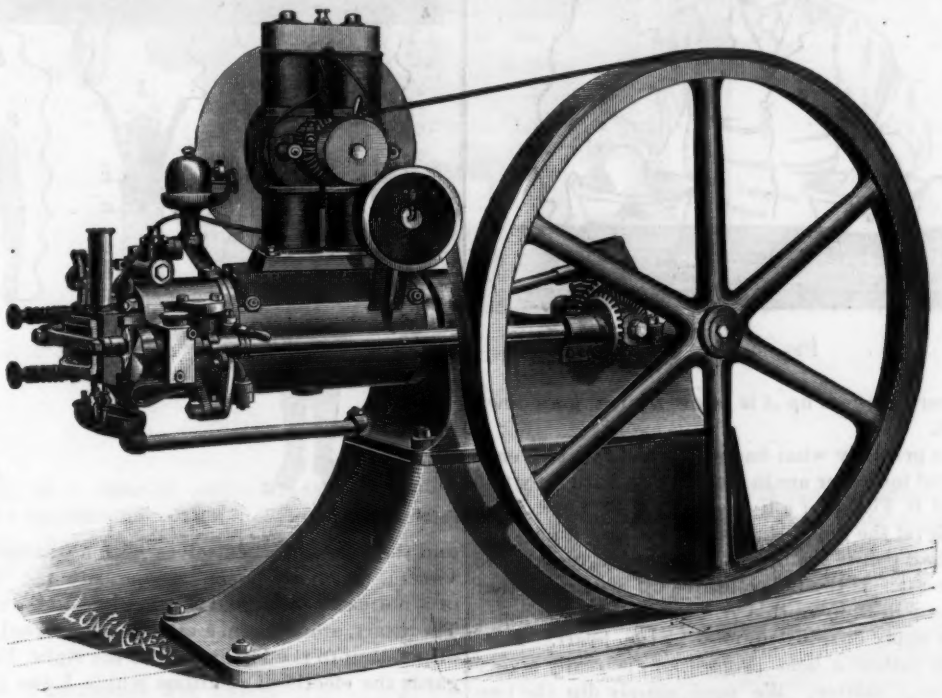


BRUSH INCANDESCENT PLANT ON U. S. S. "BOSTON."

vulsed the audience with laughter. After the meeting those present inspected Mr. Edison's splendid library, which is especially rich in the transactions of societies, and opportunity was also afforded to view the large collection of electrical apparatus and instruments contained in the electrical laboratory. Over 250 persons were present at the meeting, and they joined in a hearty vote of thanks to Mr. Kennelly for his lecture, and to Mr. Edison for his invitation to the laboratory. Mr. Edison was present during the latter part of the evening.

Otto Gas Engine and Dynamo Combined.

The combination of engines and dynamos is mainly done with a view to economize space; and in the case of a gas engine the object is reached very readily, as the production of power is independent of boilers, and the machinery can be placed anywhere within reach of gas supply. It seems thus specially well fitted for isolated lighting of residences, offices or stores, where public stations have no circuits to connect with or where parties wish to economize by having their own plant. The engine illustrated develops over four horse-power, and according to the system of lamps used, their candle-power, etc., admits of developing with its dynamo from 30 to 40 incandescent lamps, being thus sufficient for average requirements of numerous cases.



COMBINED OTTO GAS ENGINE AND WATERHOUSE DYNAMO.

As will be seen from the engraving, the power is transmitted from the fly-wheel by a belt of moderate width, and an idler pulley is used to increase surface of contact with belt. The dynamo slides on V guides back or forward, permitting thereby the tightening of the belt when needed. There is a fly-wheel in the shape of a solid cast-iron disc, finished all over and thoroughly balanced, placed on the dynamo spindle to give steady motion, as has been the practice with the "Otto" gas engine when applied to incandescent lighting. This is a very efficient contrivance to secure the object in view and is even used in the largest of plants with "Otto" engines with perfect results; among others, in Dessau, Germany, where the Continental Gas Company has a plant of 2,000 lamps, and at the London Post Office Savings Banks Department, where 1,200 lamps of a perfect, steady light are maintained. The recent illustrations in this journal of a telegraph office, where batteries were displaced by dynamos and electric motors, reminds us that Otto engines have been used for similar work, and that the combination here described would make a very compact machine for such service. In fact, the Philadelphia local telegraph company have abandoned their batteries and replaced them by an Otto 10 h. p. engine and Edison dynamo some time since, and so has the Western Union Company in Chicago, in the Board of Trade station, using a 15 h. p. Otto engine.

Notes on Some New Sprague Roads.

We are in receipt of the following interesting notes from the Sprague Company, relative to new roads:

Construction on the Sprague Electrical Railway at East Reading, Pa., is being carried forward as rapidly as possible. The work of grading has already been finished; the greatest cut being 7 feet deep, and the greatest filling 30 feet. The grades on this road run in some places as high as 9 feet in 100. The work of erecting the poles for the overhead system is progressing rapidly. About one-half the number required are already in position. One-half the rails have been received and the rest are expected daily. Tracklaying will be commenced next week and prosecuted with a full force of hands, with the expectation of completing the road in about two weeks ready to be put into operation.

The power station at Allston for the Brookline branch of the West End Railway, of Boston, has now almost been completed. Work on the overhead system on Beacon street is rapidly being pushed forward under direction of Mr. S. D. Greene, electrical engineer of the Sprague Company. The poles on this line will all be of iron, of a neat and tasteful design, and tested up to 1,400 pounds. These poles will be set in concrete, which will prevent all possible danger of their changing position or coming down. The cars, which will all be new, are now being built in Newburyport, and will be ready for shipment shortly. It is expected that the road will be in operation within a month.

The Sprague Electric road at Akron, Ohio, which has now been in operation for about three weeks, has been running very successfully, and carrying a large number of passengers. There are now 12 cars in operation, and these have been giving such good satisfaction that the management are understood to be considering the advisability of increasing this number. A great many people who ordinarily do not use the street railway cars, have been riding upon the electrical cars, being curious to try the new motive power.

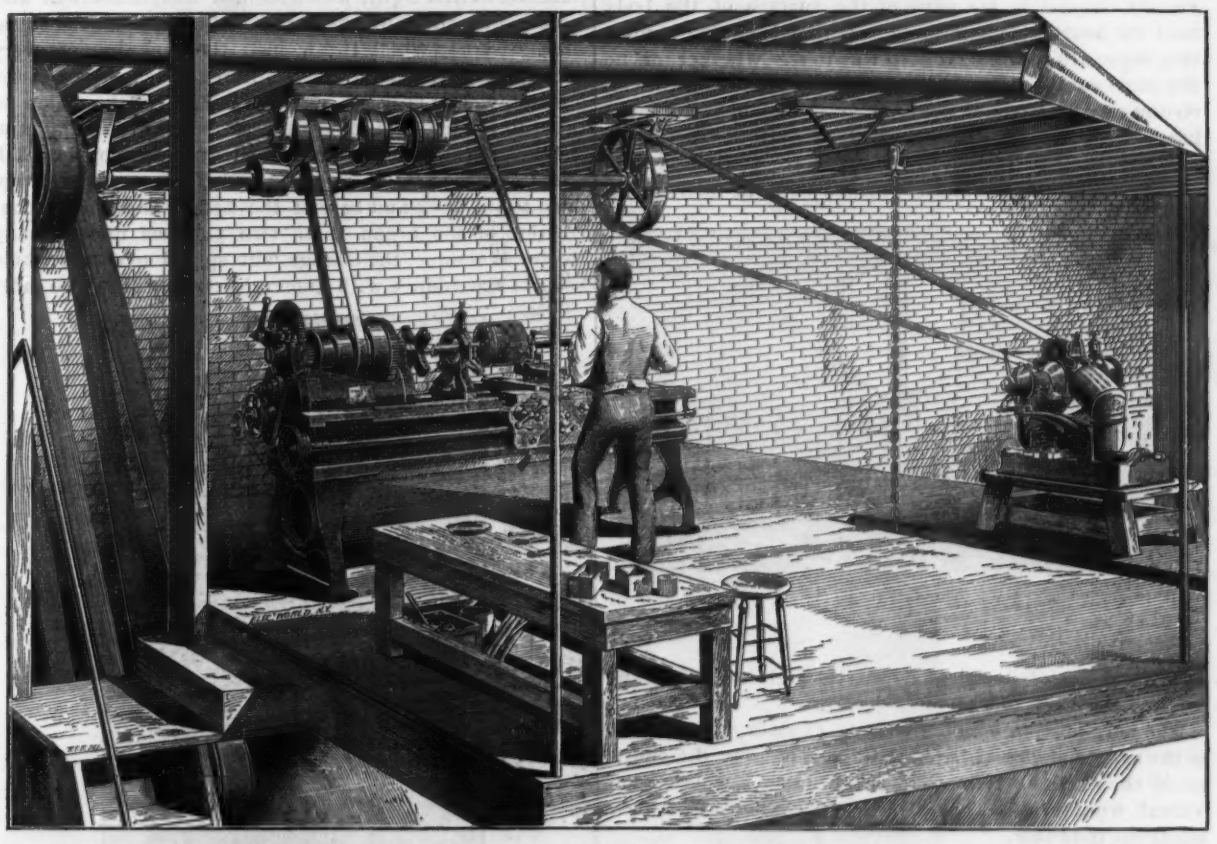
The two electrical railways which are in operation on the Sprague system in Wilkesbarre, Pa., have been running for some time and have been giving a universal satisfaction to officials and passengers. The cars run smoothly, are under perfect control, and their cost of operation is only about two-fifths the cost of operating the same number of cars by horses. The first portion of the electrical equipment consisted of 7 cars, but their success was so marked that the original order was supplemented by another order to the Sprague Company for an additional equipment. There is no doubt in the minds of anybody in Wilkesbarre but that electrical street railway propulsion on the Sprague system is in every respect a great success.

Flexible Hard Rubber Insulation.

At Wilmington, Del., the Cobb Vulcanite Wire Company are manufacturing wires and cables insulated with hard rubber by a new process whereby it is rendered flexible. The results obtained, as shown by tests made by Mr. Carl Hering, Professor Houston, and Mr. Mehren, Professor Barrett's assistant, have attracted the attention of electricians to the wire, and those who have seen samples of it or have heard of it are anxious to learn more about this form of insulation. During a visit to Wilmington recently the writer visited the works of the Cobb Vulcanite Wire Company, occupying a whole block—or square, as they would say in Wilmington—and the buildings cover almost the entire property. In general these buildings, which are of brick, are one story in height. There are railway tracks throughout all the different departments, so that heavy coils of cable and the like can be easily and conveniently transported from building to building. The property has a frontage of several hundred feet on the Brandywine Creek and its own private dock, at which vessels with coal or freight can unload, or from which the product of the works can be shipped direct by water to New York, Philadelphia and other seaports.

Some of the patents are still pending, and Mr. Cobb, who is the inventor, as well as president of the company, does not yet care to have the process of manufacture published. The insulation, however, is made in the metal armor, which is usually lead, and it is vulcanized in such a manner that the rubber is not burned, but, though hard is flexible and capable of being bent at any angle. While it is being vulcanized the insulation is subjected to a pressure of 75 pounds to the square inch, which condenses or solidifies the insulation and gets rid of the air holes. This, Mr. Cobb claims, makes the insulation perfect and accounts for the high conductivity, as well as the high insulation, as shown by the tests. The fact that the wire is not close to the insulation is the reason, Mr. Cobb thinks, why the inductive capacity is so low.

The wire is put in last, and is not subjected to any heat.



BAXTER MOTOR IN THE FOURTH AVENUE STORAGE STATION, NEW YORK.

The Baxter Motor at the Julien Station, New York

In our recent description of the station which has been fitted up by the Julien Traction Company for the operation of the storage cars on Fourth avenue, in this city, the fact was mentioned that the machine shop connected with the plant derived its power from a Baxter motor of 6 h. p. Our engraving shows the repair shop as it appears in the station, suspended from the upper floor beams so as to be out of the way. The motor, as will be seen, drives the countershaft and furnishes power for working the lathe and other tools. In addition to this it operates a five-foot ventilator, which is kept in constant motion, so as to maintain the purity of the atmosphere of the stable. Still another kind of work performed by the motor is the raising of the coal from the cellars. The coal is fed into a bucket ventilator, which can be seen in

Joints are only made every 500 feet. The cable is no larger at joints than at other parts, and it is said to be just as good at joints as elsewhere.

The works have a capacity of five miles of electric light cable a day. Just now they have a large order on hand for furnishing cables for the city of Chicago. The Edison Company in Philadelphia is also using the cable. The rubber machines, of which there are six in the works, are manufactured by John Royle & Son, of Paterson, N. J. The large machine for covering with lead was manufactured by John Robertson, of Brooklyn.

The Electromotive Properties of the Human Heart.*

BY A. D. WALLER, M.D.

It is a well-known fact that every beat of the heart is accompanied by an electrical disturbance; the nature of this disturbance has, moreover, been studied and understood with the assistance of cold-blooded animals, and in this laboratory in particular an investigation was carried out to learn whether or no warm-blooded animals mani-

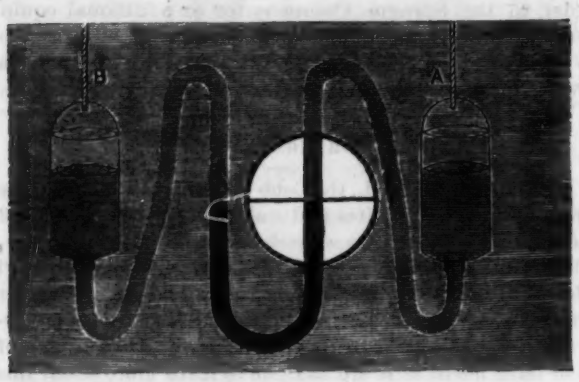


FIG. 1.

fest similar electrical disturbances. These I will not now enter upon, and will only make the passing remark that, while to all appearances the electrical disturbances are similar in the two classes of animals, they are not identically so; these seem to indicate that the contraction, which at each beat of the cold-blooded heart runs down from the base to the apex, runs in the opposite direction in the warm-blooded heart. But this is only by the way, and I make no attempt to explain. It is to the next step that I invite your attention to-day, namely, to the human heart.

Led on from thought to thought it occurred to me that it should be possible to get evidence of electrical action on man by connecting not the heart itself, which is obviously impossible, but parts of the surface of the body near the heart with a suitable instrument; having verified this supposition, the next step was to see whether or no the same evidence can be obtained by connecting the instrument with parts of the body at a distance from the heart with the hands or feet. The answer was, as you can well see, satisfactory. Finally, I tried whether two people holding hands and connected with the instrument,

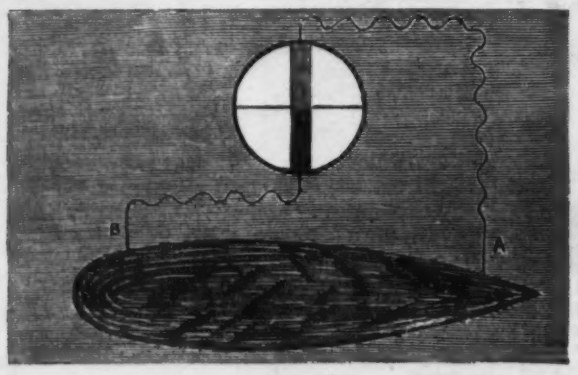


FIG. 2.

gave evidence of electrical shocks through each other, and I found they did.

The only portion which I wish to explain in any detail is the second step in these experiments, namely, the analysis of the results which are obtained when a single individual, whether man, horse, or dog, is connected with the electrical indicator.

Let me briefly explain the principle of action of an electrical indicator† by referring to this diagram, in which the effects of water pressure are compared with those of what I may call electrical pressure (potential is the correct term, but I take it to be part of my task to-day to avoid technical terms).

A and *B*, Fig. 1, are two bottles of water, each connected by flexible pipes with a bent tube half full of mercury. If the two bottles are at the same level, the mercury in the bent tube remains at zero, and it is evident that this is still the case if both bottles be raised together or lowered together. But if the bottles be moved unequally, either up or down, the level of the mercury will alter. It is obvious that if *A* is lower than *B* the mercury in this limb of the tube will move upward, whereas if *B* is lower than *A* it will move downward. And if we imagine everything hidden from us by a screen, with the exception of this portion of the tube, which we can view through a circular opening, while the two bottles are being moved by unseen hands, it is obvious that we shall be able to tell by the movements of the index whether *A* is below *B* or *B* below

FIG. 3.

A. If the mercury goes up *A* is below *B*, if it goes down *B* is below *A*.

Now this is precisely what happens when the two ends of an electrical indicator are in connection with any two points, *A* and *B*, Fig. 2, of a living body. If *A* and *B* are at the same level the index stands at zero, and it does not move if the two points are raised or lowered together to an equal amount. If the index moves up we know that *A* is lower than *B*, if down that *B* is lower than *A*.

Let us now apply our instrument to the heart. This, which seems rather a bold proposition, is really a very simple and easy matter. We need simply dip the two hands into two basins of water which are in connection with our indicator, Fig. 3, when we shall see that the mercury beats up and down with the pulse. These movements of the mercury are due to the electrical changes which occur with every beat of the heart; or we may dip a hand and foot each into a basin of water, with a similar result, only it must be the right hand, the left will not do. This difference, apparently so curious and puzzling at first sight, which seemed unsymmetrical and irrational, is in reality most reasonable, and proved to be the master key which threw open the meaning of every subsequent experiment. The difference depends upon the unsymmetrical position of the human heart, which is tilted to the left side somewhat, as shown in this diagram.

Allow me to return for one moment to the physical A B C of the subject. The points *A* and *B* are respectively applied to the apex and base of the heart, and if with contraction of the organ these two portions undergo any electrical change, the change will spread over the whole body in accordance with known laws. I will say no more

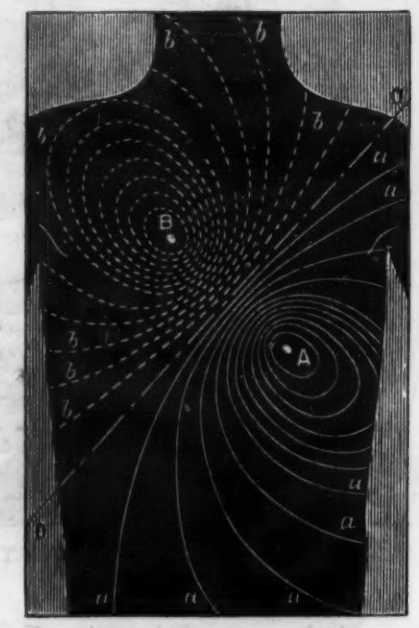


FIG. 4.

than that. The form of the change is represented by these oval lines, Fig. 4. If the electrical level falls at *A* it falls over the red area* which, as you see, includes the left hand and foot and the right foot. If the electrical level falls at *B* it falls over this blue area, which includes the right arm and the head.

Now it is obvious that the two ends of the indicator must be connected with *A* and with *B* before it will indicate any difference between *A* and *B*. If both ends are connected with *A*, or both ends with *B*, nothing will be seen. This was precisely what we got when the left hand and a foot were connected with the instrument, which begins to pulsate as soon as the right is substituted for the left hand. I might multiply instances, but will only just mention one. If the mouth and right hand are connected with the instrument, its index does not move, but it does so as soon as the left hand is put in the place of the right one. You must connect up a blue and a red point; two blue points or two red points are ineffectual.

But this evidence does not stand alone. Cases every now

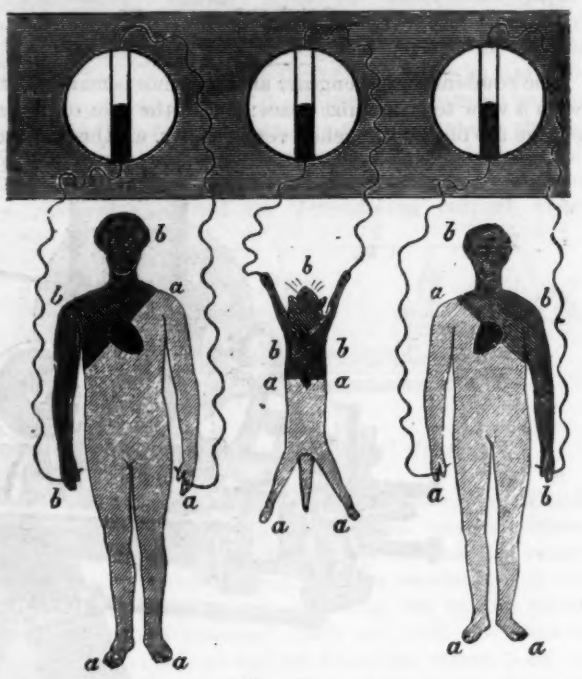


FIG. 5.

and then present themselves with a transposition of the viscera, which are in such people situated just like those of a normal person as they would be viewed in a mirror. The heart, among other organs, is reversed, and, instead of pointing to the left, points to the right, Fig. 5. As regards the electrical relations which I was following out, they were precisely as expected. The left arm was in this case the exceptional limb, and formed an effectual couple with any one of the other three limbs, but was ineffective in combination with the mouth. To make a long story short, the results were throughout as indicated in the diagram; any two blue points or any two red points in connection with the indicator were silent, but as soon as connection was made with a red point and a blue point, then the index moved with each pulsation of the heart.

Let us hear one more witness. The heart of a quadruped (dog, or cat, or rabbit, or horse) is placed far more symmetrically than in man; it is very nearly in the middle line, Fig. 5, so that the changes of electrical level whose foci

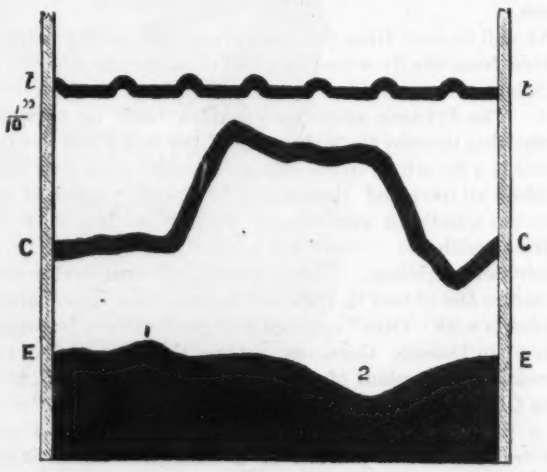


FIG. 6.

C C, cardiogram. *E E*, electrometer tracing. *t t*, time in tenths of a second.

are at *A* and *B* spread straight up and down the body, not obliquely, as in man. The other half of the body is under the influence emanating from *B*, the lower half under that emanating from *A*. Unlike what occurs in man, the two front paws coupled with an indicator are silent, while either front paw taken with either hind foot gives us the now familiar answer.

These are the principal facts. What can we learn from them with regard to the normal action of the heart? I must be content with simply stating the answers.

The fact that each beat of the heart gives an electrical change, beginning at one end of the organ and ending at the other, proves that the contraction does not occur throughout the mass of the heart at one and the same instant of time; if the two points *A* and *B* rose and fell together, there would be no alteration of the index. The movements of the index, as illustrated in the diagram, Fig. 6, show that there is a fall of *A* at the beginning of the contraction, and a fall of *B* at the end of the contraction. One of the most fundamental and certain facts of physiology is that the active state of a living tissue is marked by a fall of electrical level; in other words, an electrical depression is the best, most certain, and most delicate physical sign of physiological action; it proves

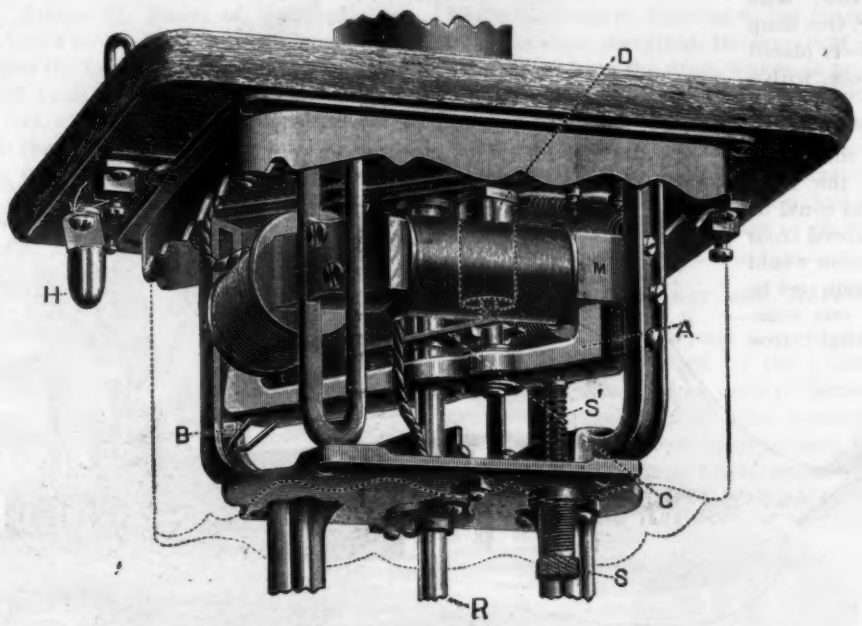
* Abstract of a lecture delivered at St. Mary's Hospital Medical School, London.—London *Electrical Review*.

† The indicator actually employed was Lippman's capillary electrometer.

* The diagrams used in the lecture were in red and blue. In the woodcuts as printed, red is light shading, blue is dark shading. In the diagram, Fig. 4, red is represented by plain lines, blue by dotted lines.

the fact that living tissue is in excitement as certainly as a dog's bark proves that a living dog is in excitement; *A* barks first, *B* barks last. In the contraction of the human heart the beat begins at the apex and ends at the base.

We have here the answer, and more than the answer, to a question which has often been asked but never settled, namely, does the heart (that is, the ventricles) beat simultaneously in every portion, or does the contraction take place progressively, as a state of action traversing the whole mass from a begining to an end? The answer is a distinct affirmation of the second alternative to the exclusion of the first, with the additional and unexpected rider that the contraction begins by the apex and terminates at the base.



THE WATERHOUSE ARC LAMP.

The Waterhouse Arc Lamp.

We illustrate on this page the operative details of the Waterhouse arc lamp. The lamp magnet is of a new form, being quadrangular in shape, having the shunt and main conductors wound at right angles to each other, producing two variable poles and two constant poles. The variable poles are utilized to attract an armature *A*, which is held in position by a pivot over the supports *B*, and to it is attached the clutch *C*, which imparts movement to the carbon rod *R*; and on the drawing up of the armature the arc is formed. A sudden upward movement of the armature is opposed by the air dashpot *D*, and any sudden downward movement is prevented by the spring *S'*. When no current is passing through the lamp, the armature *A* is held in position by the supports *B* and spring *S'*.

As the carbons burn away a stronger resistance is found in the main or light circuit than in the shunt, and a portion of the current passes through the shunt, neutralizing the magnetism in magnet *M*, and allowing by gravitation the armature *A* to recede slightly, which eases up on the clutch and the lamp feeds. The adjustment of the lamp is made by moving the screw *S*, which changes the tension of the spring *S'*. This will regulate the length of the arc desired. An automatic cut-out (not shown) is arranged on the opposite side of the magnet, which cuts the lamp out on a quarter of an inch separation of the carbons.

The lamp is thoroughly insulated and the same form of magnet is used in the rack feed as well as the double lamps furnished by the Waterhouse Electric and Manufacturing Company, of Hartford, Conn. The company consider that they gain notable advantages in the freedom of the mechanism from friction and in the extreme susceptibility of the regulation to the changes in the length of the arc.

Uptown Edison Station, New York.

We present on this page an exterior view of the magnificent new Edison station, just completed on West Twenty-sixth street, this city. As will be seen, the architecture is quite ornate, yet solid and massive in general effect; and the steam and electrical plant when installed will be thoroughly in keeping. It is understood that the capacity will be 30,000 lights.

Universality of Vibration.*

BY C. C. HASKINS.

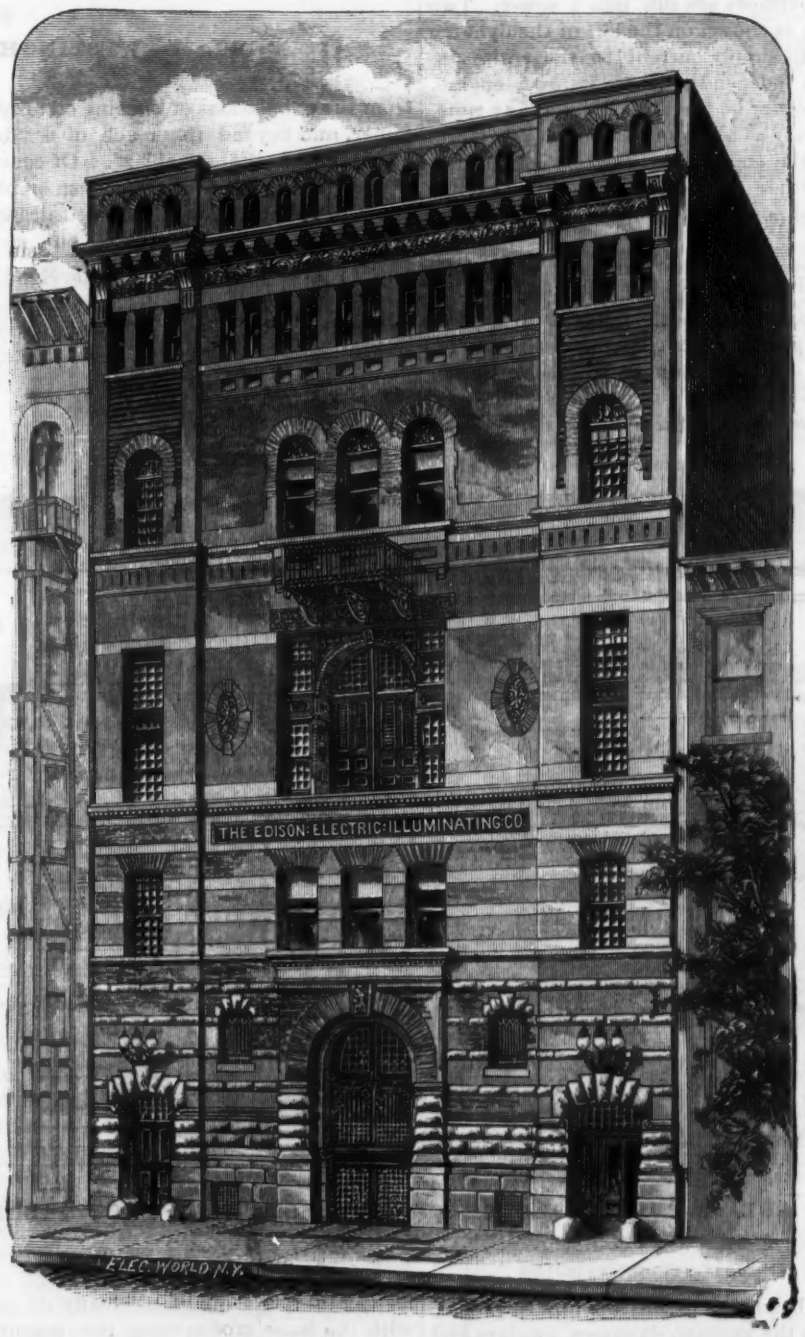
Vibrations in the most limited sense of the term are defined as minute reciprocal motions of the particles of an elastic body when they are thrown out of equilibrium. Oscillations embrace a class of movements which may be termed vibrations of greater dimensions, the two differing only in degree. These may be transverse, vertical arcs or horizontal curves, part or whole of circles or ellipses. Amplified still further we find movements embrace extended circles of time, yet ever returning to a former condition or position. These are all, generically speaking, vibrations differing only in the one element of time. We may go further and include as vibrations all that class of change or motion which has the one common similarity of starting at a given point, origin or condition, and having accomplished a change of place, form or position, or a cycle of motion or condition, return to the pristine condition, again and again repeating this round of different positions. These periodic motions, whether comprising two or more changes, whether polar or molecular, I have classed as vibrations, and within this scope I include the movements of all elastic bodies, light, heat, gases, etc., the gyratory movements of storms the progress of planets in their orbits, and those chemical changes which are ever active in unfolding, combining and producing in the mineral, animal and vegetable world by which the various conditions of growth and decay are constantly and regularly succeeding each other.

A fine example of vibratory changes from an electrical and chemical standpoint is the sulphate of copper battery. The sulphate, which is soluble in water, forms one of the elements of the battery, while zinc is used for the other. When these are placed in water and the connection made which renders the circuit complete the stored up energy of the elements is released, the sulphate of copper is dissolved and its component parts are separated, and this action is continued until the elements are recombined. By evaporating the water and weighing the residuum, just as much copper and zinc and acid is found as originally existed, but the combination has been altered. The acid and copper by further manipulation is made to complete the cycle of vibration. A second battery similar to the former can be erected from the same elements.

Water in motion produces a good illustration of one form of vibration. The vibrations of a larger body of water, like the sea, are examples, and only vary in degree of amplitude. The waves, the tides, the currents, the very color of the sea, are as strictly amenable to vibratory law as are the strings of the violin or the pipes of a church organ.

Sight, hearing, taste, touch, are clearly vibratory in their action. A clear conception of distance beyond a limited range is difficult to obtain. The sun, the stars, by reason of their great distance from us, appear as mere points of light. Sirius, being at such an immense distance, seems further away than Venus, which is much less brilliant. A substance known as the luminiferous ether fills all space throughout the universe. Vibrations from luminous bodies are taken up by it to be transmitted by wave motions. Light is conveyed in the same manner in which sound is conveyed by air waves, with, however, this marked difference; sound waves move in one direction while those of light move at right angles to this. The mechanical properties of ether are rather those of a solid than an air. Light is susceptible of divisibility, which is shown in the rainbow and in the triangular prism. The different hues are due to the different rates of vibration and the different angles of reflection.

In conclusion, the speaker said vibratory law lies at the very bottom of all vegetable and animal life; to it we are indebted for all that is beautiful in nature; it gives us all the magnetic and electrical actions, the telegraph and telephone, the fire alarm and the electric light. Our batteries would be powerless without it; without it there would be neither heat nor light nor color.



NEW EDISON CENTRAL STATION, NEW YORK.

* Abstract of paper read before the Chicago Electric Club, Oct. 29, 1888.

A Model Westinghouse Central Station.

In our last issue we described a number of new devices and apparatus embodied in the Westinghouse system of alternating current distribution, and we are now able to present to our readers the general arrangement of a Westinghouse station and power plant as a whole. The subject, it will be remembered, was treated by us in September in our illustrated article on the Denver station. A typical example of the arrangement is the station of the East End Electric Light Company, at East Liberty, Pa., which is shown in perspective in the acccompanying engraving, Fig. 1.

The service from this station covers a very extended area, comprising the business portion of the city, which lies within an average distance of half a mile from the station, ramifying through an extended series of residence streets of the better class, and carrying one special line out as far as the remote suburb of Swissvale, the last lamp being a distance of 4¼ miles from the dynamo.

The arrangement of the station is clearly indicated in Figs. 2, 3 and 4, which show three views of it. It is a substantial but inexpensive one-story building of brick, containing the offices of the company and the storeroom for material, in addition to the dynamo and boiler room. The plant at present has an aggregate capacity of about 8,000 lights. Dynamos and engines are on the same floor, every part of which is constantly under the eye of a single attendant. Both engines and dynamos stand on brick foundations, the floor itself being of cement. Each engine is belted direct to its own dynamo, no power being wasted in transmission, and the sub-division into units enables the wide fluctuations of load to be met by stopping and starting each engine and dynamo as needed, thus operating the whole station under the highest possible economical conditions at any moment.

The steam pipe is brought along the engine room overhead, and the engines exhaust into a main laid in a covered trench underneath the floor, every part being accessible. All drips and overflows are run into a sewer. Two exciters are provided, as shown on the left of the dynamo room, each adequate to supply current to the entire station and each driven independently by its own engine. But one engine and exciter is, therefore, run at any time, the other standing ready as a relay in emergency. Moreover, the position of the engines and exciters is such that by changing a belt either engine can run either exciter and thus the chance of possible stoppage is reduced fourfold.

Two overhead traveling cranes traverse the whole length of the building over the engines and dynamos.

In a station so arranged the labor is reduced to a minimum. With natural gas, of course, but one fireman is required, or firing with coal, two firemen will be on duty in the first run of the evening and one in the second run. But one attendant is required in the dynamo room at any time, the lightness of his duties permitting him to give all necessary attention to the engines, dynamos, exciters and switch-board.

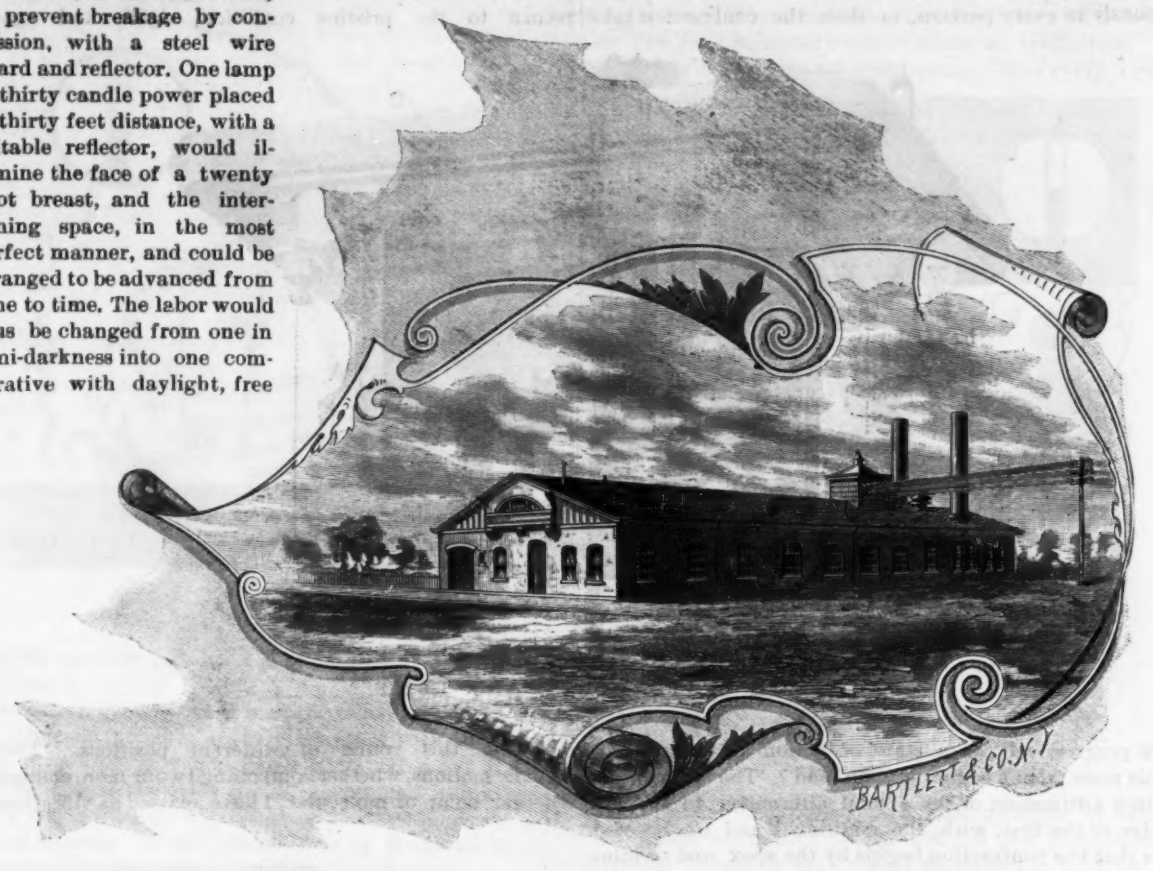
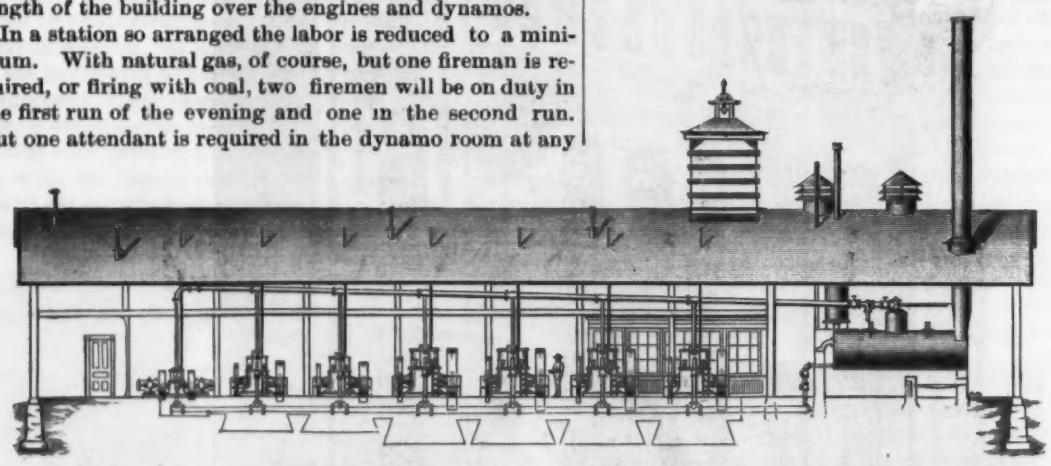
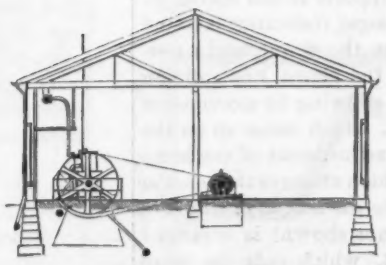
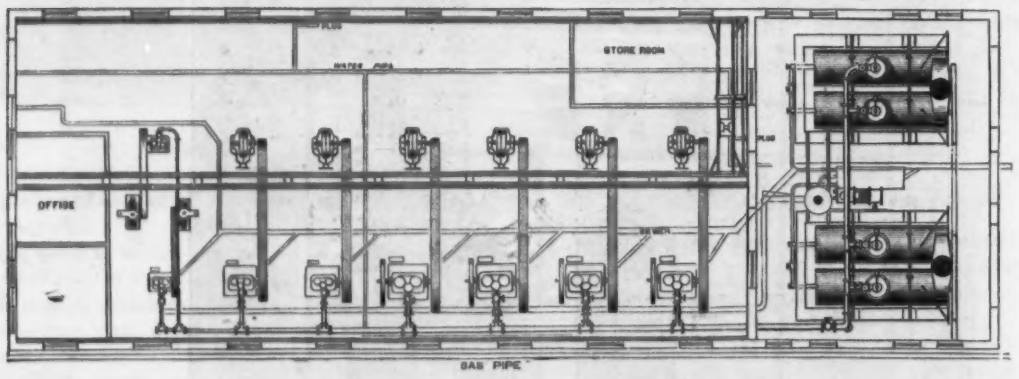


FIG. 1.—WESTINGHOUSE CENTRAL STATION, EAST LIBERTY, PA.







FIGS. 2, 3 AND 4.—WESTINGHOUSE CENTRAL STATION, EAST LIBERTY, PA.

Electric Lighting in Mines.

Mr. Hiram Haines writes to the *Engineering and Mining Journal* as follows: The few obstacles in the way of adapting the incandescent light to the illumination of mines can, and will no doubt, be promptly removed. The chief among these is cost. This may be largely reduced in coking collieries by utilizing the gas from the coke ovens for making steam, not only for the power required for the dynamos for lighting, but for haulage and hoisting also, in which considerable progress has already been made. For adaptation in the anthracite and non-coking coal regions, ingenuity will, no doubt, accomplish the necessary reduction of cost to insure its ultimate adoption. I propose the application of the incandescent light, not only to mineways, but to rooms and headings also, using for this purpose a thick annealed bulb, to prevent breakage by concussion, with a steel wire guard and reflector. One lamp of thirty candle power placed at thirty feet distance, with a suitable reflector, would illumine the face of a twenty foot breast, and the intervening space, in the most perfect manner, and could be arranged to be advanced from time to time. The labor would thus be changed from one in semi-darkness into one comparative with daylight, free from the exhalations of burning oil around the head of the miner, and beyond the reach of a "blower" which the head lamp would set ablaze. Of course the advantage of the system, like most modern appliances, would no doubt be to some extent commensurate with the magnitude of the mining operations; but, as previously stated, its adoption is a question chiefly of cost, and it is only with the hope of directing the ingenuity of our electricians into this field of usefulness, which is great, that my suggestions and inquiries have been made. It should, I think, be the aim of the engineer to impart the greatest possible efficiency to the labor that comes under his charge. This can obviously be accomplished by improving the conditions under which that labor is to be performed. If improving those conditions be attended with an amelioration of the life of the laborer, it becomes also a progress of humanitarianism. We may therefore exercise both economy and humanity. All properly conducted operations require the one, and labor has a right to the other.

New York Steam Pipes and Electrical Subways.

At the meeting of the Board of Electrical Control on the 23d ult., the uppermost question, and one which seems likely to give rise to grave issues, was that of the excessive heat caused in the subways by the defective steam pipes of the Steam Heating Company. The engineer of the board, in reporting progress in the matter of the investigations that have been instituted, stated that Broadway had been opened at Exchange place to the depth of 13 feet, and excavations had been made north and south for 75 feet each way. The leaking joints had been packed with lead and rimmed with iron wherever found; but the earth was so hot that it would probably be a week or 10 days before they could get at the big leak that is the supposed cause of the serious damage to the cables. Com. Gibbens urged upon the consideration of the board the question whether the subways in the lower part of Broadway were in an untenable condition or not, and if they were, what could be done to render them tenable. He wanted to know why the Western Union Company pleaded difficulties in carrying out the orders of the Board which the Metropolitan Telephone Company, under less favorable conditions, had overcome. He said that the most specific report on all these points should be given by the engineer and the expert. The chairman stated that the report would be presented at the next meeting.

A letter was read from Mr. W. J. Sefton, of the Consolidated Telegraph & Electrical Subway Company, acquiescing in certain conditions imposed by the board, and stating that they would be incorporated in the rules and regulations governing the company's occupancy of the subways.

The United States Illuminating Company were granted permission to place certain arc lamps and connect them with the existing circuits on Fulton street, Sixth avenue, Greenwich street and the Bowery.

The rules and regulations prepared by expert Wheeler were then read, but their final consideration was postponed to the next meeting so that the board could have the co-operation of the representatives of the electric light companies. The board then adjourned to Friday the 26th, but the meeting was not held.

Alternate Current Electrolysis.

Referring to the recent experiment by Chappuis and Manoeuvrier in Paris on the decomposition of water by alternate currents, it is pointed out in *Nature* that the whole question was thoroughly investigated by Sir W. Thomson in 1853, and his paper in the June number of the *Philosophical Magazine* of that year gives a large amount of information on the subject. Jamin, in 1882, showed how electrolysis could be performed by alternate currents by inserting an arc in circuit, the opposing E. M. F. of the arc producing a partial rectification of the currents. Mr. J. F. Kelly has just repeated the experiment at Newark, N. J.

Eddy's Electric Measuring Instrument.

Electric measuring instruments in which iron or steel is employed, upon whose magnetic strength the indications of the instrument depend, are open to the objection that the magnetic qualities of the iron and steel are liable to vary, and hence to effect wrong indications of the instrument after the lapse of time. In order to avoid the use of magnetic metal in the construction of electric measuring instruments, Mr. Arthur H. Eddy, of Hartford, Conn., has recently devised a novel form of instrument whose action is based upon the mutual attraction set up between the convolutions of a coil of wire by the passage of a current through the coil, so that a coil whose convolutions are free to move with the passage of current contracts in axial length; and the movement thus produced is communi-

A NEW GRAVITY DROP.

cated to an index which travels over a scale and the effect is thus indicated directly in ampères or volts.

The accompanying engraving, Fig. 1, shows the instrument in perspective, and Fig. 2 is a section of the same, showing the arrangement of the spirals. A brass bobbin *A* is made with comparatively large bore, and is wound with wire *b* to suitable depth. In the interior there is placed a double spiral of wire, *c*, wound so that one spiral is inside the other, the winding being such that the current enters one spiral at the bottom or fixed end, ascends to the top, and then returns to the bottom through the other spiral, the direction of current being parallel throughout. The two spirals *c* are at the upper or free end connected with the index or pointer *d*, which is pivoted in a bearing *e* on the spool *A*, and has its outer end moving over a scale.

Obviously, when current is passing through the spirals *c*, the various convolutions will be mutually attracted, and the lower ends being fixed to the base the mutual attraction causes a decided shortening of the axial length of the spirals *c*, which shortening movement causes movement of the pointer. The extent of movement of the pointer over the scale can be made greater by increasing the ratio

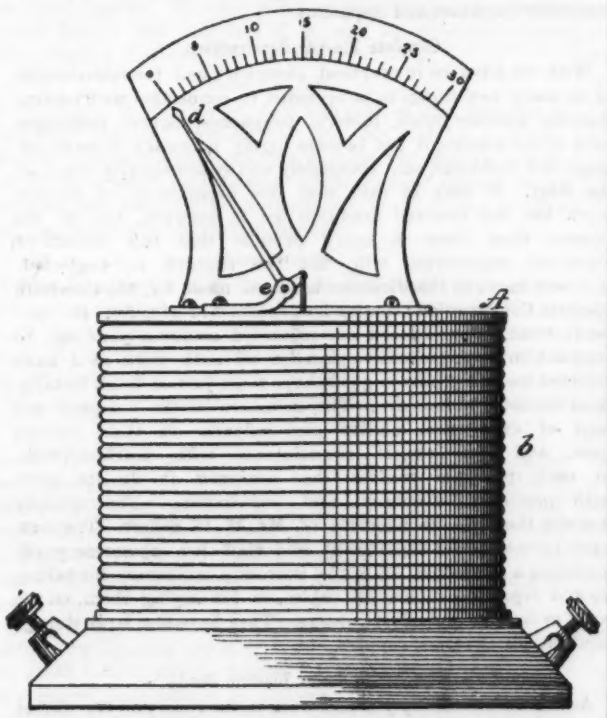


FIG. 1.—THE EDDY AMMETER.

between the arms of the lever system formed by the pivoted index *d*.

The relative movement of the spiral for given increments or decrements of current strength or potential will be proportional within certain limits, but the instrument is designed to be graduated by reference to a standard, after which its readings will be constant.

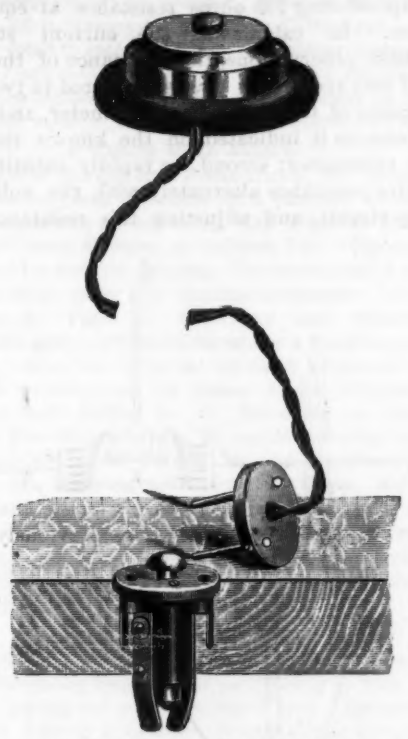
The movement obtained can be still further increased by sending the current also through the external or field coils *b* in such direction as to make the total effect cumulative. The coil or spiral *c* must of course be selected with a view to a definite range or current capacity, and Mr. Eddy keeps far within the limits which might be placed by the modulus of elasticity of the metal employed and the heat produced by the current. To reduce the latter to the lowest possible degree, the coils *b* and *c* are so connected that they shall be in multiple arc, so that a comparatively small wire can be used for the latter and the number of convolutions made considerable.

The Baxter Gravity Drop.

We illustrate on this page the new and neat little gravity drop made by H. E. & C. Baxter, of Brooklyn. It is made of Norway iron, out of which the armature and back iron are stamped, and which, as is well known, quickly magnetizes and demagnetizes. The armature is pivoted to the back iron and weighted at the top, allowing the catch to remain forward normally, holding the drop. When the magnet, fastened to the inner side of the back iron, becomes energized, the armature is drawn up and is disengaged from the drop, which at once falls by its own weight. The armature is provided with a non-magnetic piece to avoid sticking to the back plate. The drops are fitted with cases of handsome hard woods. It should be stated that the firm make it their practice to employ Norway iron in all this class of work, and were probably the first to make it a special feature of their work.

Combination Floor Key and Movable Table Button.

We illustrate on this page a very neat contrivance, designed and manufactured by the Central Electric Company, in the shape of a regular formed floor-key with the round flange made of fibre instead of brass. When the table button is required to be used, the brass connecting pin in the floor key is removed and the fibre disc with cord attached to the push button is pressed over the head



A NEW FLOOR PUSH BUTTON.

of the floor-key, and contact is made by means of two brass pinions scraping the connection in the floor button as the disc is placed.

A Statue to Ampere.

At a meeting of the French Academy of Sciences it was stated that in the beginning of last month a statue would be inaugurated at Lyons to Ampère. The authorities of that city have invited the Academy of Sciences to send a representative to the ceremony, and the President of the Republic has signified his intention to be present. The secretary recalled the various titles which Ampère has to take his place among the greatest men of science in this century. A member of the geometrical section was sent to represent the Academy at the inauguration of the monument.

Telephone Statistics.

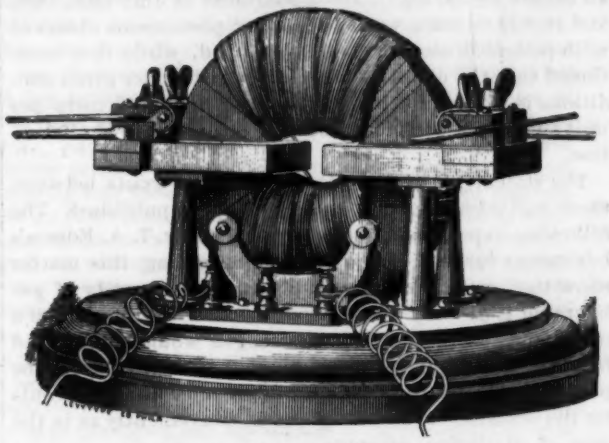
The Russian Post Office authorities have recently published some statistics relating to the position of telephony in Russia. The total length of telephone lines amounts to 7,440 versts (4,960 miles), the total number of subscribers being 3,250. There are at the present moment 941 subscribers in St. Petersburg, 584 at Moscow, 472 at Odessa and 365 at Riga. The Swiss Post Office authorities have also issued a similar report relating to Switzerland. The total number of subscribers at the end of 1887 was 5,988, being an increase of 990 since 1886; the total length of wire was 9,460 kilometres, an increase of 2,237 kilometres. The total length of trunk lines at the end of 1887 was 1,140 kilometres.

An Accumulator Locomotive.

A new method of running accumulator cars, which may yet prove to be the manner in which accumulators will be used in traction, says the London *Electrical Engineer*, is being worked by Mr. Sandwell, of Victor Works, Holloway. In this system there is not a separate motor truck, as in the "electric locomotive" system, but the motor is on the tram-car, and the storage cells are carried in a small tender, built to match the car, and hooked on behind. The advantage of this method of carrying the cells is that no alteration is necessary in the structure of the tram-cars, and when changing the cells there is no trouble in lifting or pulling the cells out, but the tender is simply disconnected and shunted away, while another one, ready charged, is hitched on behind. It will remain to be seen whether this method will prove as practical as the self-contained cars for tramway work, but it is fully evident that in some cases such a system would prove very useful.

Thomson's Electric Welding Apparatus.

In a lecture on "Electric Welding," recently delivered before the Franklin Institute, Prof. Elihu Thomson showed several types of machines for producing the current



THOMSON WELDING APPARATUS.

necessary, which he called the direct type and the indirect or induction type. Among the direct type apparatus, he showed the machine which has already been illustrated in our columns, and which consists of a special dynamo provided with a set of welding clamps. Prof. Thomson also mentioned among the direct types of apparatus the storage battery which may be kept charged from a line wire or small dynamo, and which may be discharged in parallel, and thus afford a very strong momentary current. Among the indirect or induction types of apparatus are those which take the current at a comparatively high potential from an alternating dynamo and convert it down to a current of very low potential and great volume.

The machine shown by Professor Thomson, and used by him during the lecture, is illustrated in the accompanying engraving. It consists of a ring having two windings, one of fine wire connected with the dynamo circuit, and one of coarse wire which delivered the heavy current for the welding. Professor Thomson used both the induction coil type and the direct type of apparatus during his lecture. Some of the apparatus was remarkable for its smallness in relation to the size of the pieces upon which it would successfully operate. The devices for holding the pieces in place, putting on the current, and giving the pressure to the pieces, were shown to be very simple and easily operated. He also exhibited some automatic apparatus in which the pressure given is automatic and the current stops when the weld is completed, thus enabling

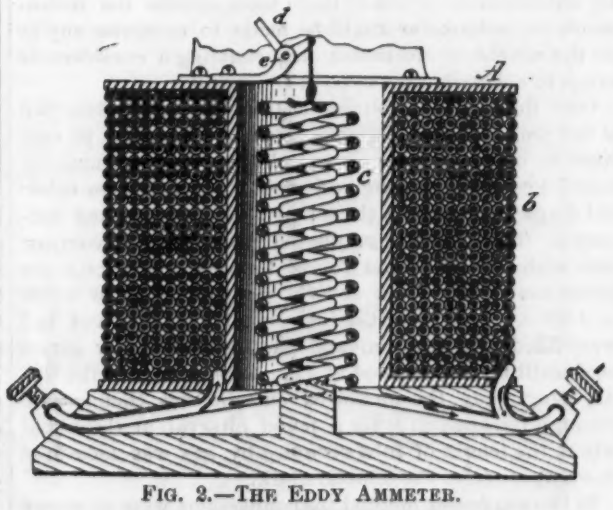


FIG. 2.—THE EDDY AMMETER.

the operation to be indefinitely repeated in the same way without involving skill on the part of the operator.

Voltametric Control of Ammeters.

In testing the correctness of ammeters, M. Latschinow measures the time which a given number of ampères take to evolve one cubic centimetre of hydrogen in the voltameter. The accompanying table gives the number of minutes which one ampère takes to liberate one cubic centimetre of hydrogen at different temperatures. It is thus only necessary to pass the current for a certain time through the ammeter and voltameter, and then to correct for pressure.

Temperature. Degree.	Time. m.	sec.	Temperature. Degree.	Time. m.	sec.
15	13	21.4	20	13	2.0
16	13	17.6	21	12	58.0
17	13	13.7	22	12	54.1
18	13	9.9	23	12	50.0
19	13	6.0	24	12	46.0

On the Voltametric Measurement of Alternating Currents.

It has until apparently quite recently been generally supposed, writes Mr. A. E Kennelly, in the London *Electrician*, that an electric current reversing its direction with the frequency that characterises what is commonly called an alternating current would not decompose water visibly; or, in fact, that if any decomposition did take place at the electrodes, the recombination at each reversal was so speedy and complete that no free gas was developed. It has been shown, however, lately, in a paper by Messrs. Manœuvrier and Chappuis,* that when the electrodes are small, free decomposition does take place, mixed gas being liberated at each. Since that time Professors Ayrton and Perry have contributed to the data on the subject in an article appearing in *The Electrician* of July 13th, 1888, and in which some very interesting phenomena observed with polarised electrodes are described, while it is mentioned that the quantity of gas liberated under given conditions is a function not only of the current density per unit surface of electrode, but also of the rate of alternation.

The statement of the connection that exists between these variables seems not to have yet been published. The following experiments made recently at Mr. T. A. Edison's laboratory for the purpose of investigating this matter show that under certain conditions the quantity of gas liberated is in very close accordance with that which a continuous current of equal strength would supply, and hence afford ground for the hope that it will shortly be possible to measure the strengths of alternating currents by the voltameter, as closely and as conveniently as in the case of continuous currents.

Two methods have been tried.

(1.) The condenser method, or incomplete metallic circuit.

(2.) The ordinary method, with complete metallic and liquid circuit.

Several series of measurements have been made, all agreeing very fairly. The source of the alternating current was a Siemens alternating dynamo machine, designed for 100 volts, the electromotive force being very readily under control through the current in its field magnets, the speed of revolution being on the occasion of this experiment very steady at 1,170 per minute. At this speed its alternations being eight to the revolution are 196 per second.

The voltameter, Fig. 1, was of special construction. An ordinary glass evaporating dish, 11.5 centimetres in diameter and 6.3 high, was filled about two-thirds with a 10 per cent. (by weight) solution of pure sulphuric acid in distilled water, the density of this solution being 1.065 at 19 degrees C. At the bottom of the dish was immersed a disc of resinous material 5 centimetres in diameter and 1.2 centimetres high. Twelve platinum wires of different lengths, but equal diameter (0.0178 centimetre), projected vertically from the upper surface of the disc, so as to stand in a ring of 4 centimetres diameter, and equidistant from each other. These wires were ranged from 1.5 centimetres down to 0.025 centimetre in length, the corresponding wires across one diameter having as closely as possible equal lengths. Connections with rubber-covered wire, sealed in the material of the disc, made six little separate voltameters, each with its own pair of insulated leads. By uniting more or less of these leads outside the instrument, the voltameter might be made to comprise any or all the couples of electrodes, thus enabling a considerable range of electrode area to be at command.

Over this sextuple voltameter there rested a glass bell seven centimetres in diameter, terminating after 10 centimetres of elevation in a vertical glass tube of uniform bore 7.5 centimetres long and about 0.6 centimetres internal diameter, closed at the top by a rubber tube and fish-clamp. This tube was graduated for volume by comparison with a burette, and found to have a capacity per linear centimetre, from several measurements, of 0.2684 ± 0.002 c. c. In using the instrument, the tube and bell were filled with solution, and gas electrolytically generated until the latter stood at a certain mark near the top. All being ready, the measured current was then passed through the apparatus for a noted interval, at the end of which the length of tube occupied by gas was measured downwards from the fiducial mark.

In the condenser method the connections were as shown in the diagram where A is the adjustable condenser; V the voltameter with commutators c c for connecting the separate couples of plates in multiple; B U a Cardew voltmeter; and LL the leads to the dynamo.

Under these conditions we know that the absolute quantity of current passing through the voltameter, assuming that the periodic variation of electromotive force follows the sine law,

$$Q = n \pi e k t \times 10^{-7} \qquad (1)$$

where Q is the absolute quantity of electricity that traverses the voltameter in time t; e is the mean alternating potential = difference, as indicated by the Cardew voltmeter B; k is the absolute capacity of the condenser A; and n is the number of alternations per second.

This formula is thus independent of the resistance of the voltameter, which is quite negligible under these conditions. If V_0 be the volume of gas at zero centigrade theoretically decomposed by a continuous current c, in absolute measure equivalent to the passage of this quantity Q, we have

$$c = n \pi e k \times 10^{-7} \qquad (2)$$

and

$$V_0 = 5.43\, n e k t \times 10^{-7} \qquad (3)$$

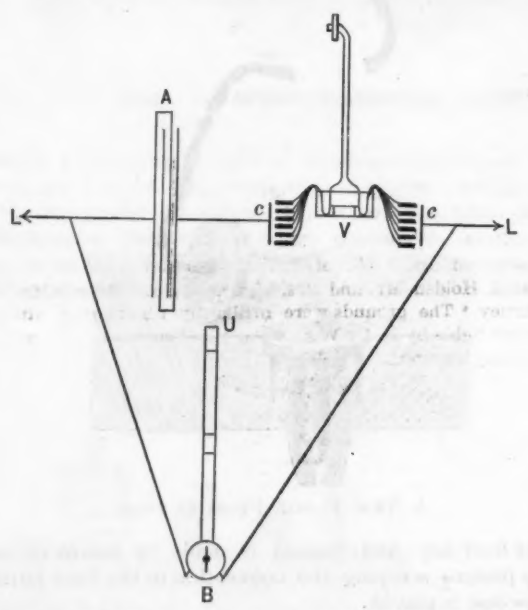
Besides the Cardew voltmeter steady potential indication, a quadrant electrometer, not shown in the diagram, with its needle connected to one pair of quadrants, was employed to measure the potential difference at the voltameter terminals, and thus indicate its mean resistance.

The condenser used was adjustable from 0.001 up to 5 microfarads, and is probably accurate to at least 0.5 per cent.

The experiments showed that—

When the density of current per square centimetre of either electrode was	The percentage of gas actually generated of that calculated as due was Per cent.
1.12 ampère	6.2
7.90	38.0
30.04 (average)	82.6
31.35	78.4
46.10 (average)	89.3
50.10	100.8
62 60 (average)	95.3
69.70	98.0
141.80	95.6

Several trials were taken without condenser, and with non-inductive resistances in its place. In one trial this resistance was a length of fine platinum wire (hot). In another trial the resistance was a 96-volt 10 candle-power Edison lamp, offering 230 ohms resistance at equivalent illumination. In calculating the current strengths for these three observations, the resistance of the voltameter itself was required. It was measured in two ways: First, by means of the quadrant electrometer, and the potential differences it indicated on the known resistance and on the voltameter; second, by rapidly substituting a non-inductive resistance alternately with the voltameter in the lamp circuit, and adjusting this resistance until



ELECTROLYSIS WITH ALTERNATING CURRENTS.

the illumination was equal in both cases. These two methods concurred in showing the resistance of the voltameter to be 30 ohms, and the maximum resistance it offered through the whole series was 35 ohms.

These results showed that:

When the current density per square centimetre of either electrode was—	The per cent. of calculated gas actually liberated was—
20.9	52
59.3	95.3

These results, corroborated by several previous series, go to show that for a rate of alternation of 200 per second, and currents of between 0.1 and 0.35 ampère, the quantity of gas generated by an alternating current in a voltameter is approximately equal to that generated by an equal continuous current when the mean current density at the surface of the electrode is above 50 ampères per square centimetre of each; that below that density the quantity of gas developed rapidly diminishes, and that below one ampère per square centimetre soon disappears.

Also that the resistance of a voltameter with very small plates, traversed by an alternating current, is much less than that it would offer an equal continuous current. Were this not the case, the resistance of a voltameter for alternating current measurements might for many purposes prove prohibitively great.

*See THE ELECTRICAL WORLD, Aug. 4, 1888.

Aiding the Jacksonville Telegraphers.

Some little time ago the Magnetic Club of this city undertook in a quiet way to supplement the good work being done in aiding the yellow fever sufferers at Jacksonville, Fla., by raising a little fund for the telegraphers there, among the club members. We are indebted to Mr. C. P. Bruch, president of the club, for the following letter addressed to the treasurer, Mr. John Brant, showing the result of the effort:

DEAR SIR: The telegraphers of Jacksonville beg to acknowledge the receipt of your favor of the 18th inst. with draft for $56 inclosed.

This token of sympathy and interest in our behalf is most sincerely appreciated by each and all of us, and could any of us have been present at Martinelli's on the 18th our toast would have been: "The Magnetic Club: Long may it live and prosper, and be the source of untold enjoyment and pleasure to its officers and members."

Sincerely yours, J. P. RIVERS,
Treas. Oprs. Y. F. Fund.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, Oct. 29, 1888.

Photographs of Machinery.

Picken & Co., photographers, of 79 Greenwich avenue, make a specialty of dynamos and other machinery, and can show many good examples of their work.

The Water Primary Battery.

Mr. H. R. Pierson has secured the fine salesrooms on the main floor of the Telephone Building, 18 Cortlandt street, and is fitting them up nicely to exhibit the Water Primary Battery Company's system.

Cutting Metal.

In many of the leading manufactories in the electrical line it is necessary to cut up large quantities of metal. Mr. F. W. Gesswein, of 39 John street, makes circular saws and cutters or burrs for this class of work, in a variety of sizes, for the different metals. He is also maker of Elterich's improved short tap and improved tap wrench.

An Electric Cigar Lighter.

A new electric cigar lighter may be seen in M. Kalfon's cigar store, 1 Cortlandt street. It operates by placing the finger on a key which closes the circuit of an electric gas lighter. The gas is thus lit, and when the key is released the gas goes out. The device is simple and convenient, and moreover the gas is only burned when in actual use.

The Electrical Accumulator Company

Have been installing some central station plants lately. One is of 360 cells, the first installment for the United Electric Light Company, of Springfield, Mass., and another is that of the Somerville, Mass., Electric Light Company. They have just closed a large contract for Narragansett Pier, R. I. Mr. W. Hood and Mr. T. P. Conant are west in the interests of the company.

Wiring the "Times" Building.

Mr. George H. Pride, of 9 Dey street, this city, is hard at work wiring the magnificent new *Times* Building, adjoining the Potter. I understand that he will complete his work early in November. I have myself seized the opportunity to inspect some of the work being done, and my attention was particularly arrested by the finish and beauty of the joints, which, of course, are numerous in such a plant. Mr. Pride is using the well-known Grimshaw wire, and also has not spared the P. & B. paint, which is freely used throughout. The wiring work has been done with commendable quickness and dispatch.

Complete Electric Construction.

With the advance in practical electricity and the introduction of so many new things to be operated in connection with central stations, whether lights, motors, telephones, tickers, messenger calls or fire alarms, it has become highly necessary to have the large new buildings, etc., completely and systematically wired at the start. It may be said that this department of electric work has not received attention as it deserves, but at the present time there is every promise that this branch of electrical engineering will not be slighted or neglected. A recent move in this direction has been made by the Complete Electric Construction Company, of rooms 312-314, No. 18 Cortlandt street. This concern was organized nearly a year ago to contract on a comprehensive plan for all such work as I have referred to, and is now in good shape to do justice to all installations intrusted to its care. The members of the company are men of experience, ability and influence in their various lines, and their expert acquaintance with matters within each province enables the company to do its work with precision, accuracy and satisfaction. The company is under the able management of Mr. W. G. Sellers. The company have a special department and staff for submarine work, including a steamboat with the necessary appliances for taking up and repairing submarine cables, or for laying them, on the coast or in lake and river waters. They have also large storage facilities for electrical supplies, etc.

The Fulton Street Electric Road.

As was mentioned by you last week in the report of the Street Railway Convention, an agreement has at last been entered into in this city by the North and East River Railway Company and the Bleecker Street Railway Compay, by which the former will at last be able to operate a line of electric street cars from Fulton Ferry, by way of Fulton street, to the west side ferries from Liberty street to Chambers street. The terms of the agreement have not been made public, but it is known that the Bleecker street company has conceded to the Fulton street road the right to the common use of its tracks along Fulton street from Front to William street. The contractor of the Fulton street road, F. W. Child, states that the new road would be in operation by the middle of December, that practically nothing remains to be done but to lay the conduits of the Bentley-Knight system, and that this work will be commenced immediately. The work of building the Fulton street road was begun on July 2, 1887. The Bleecker street road has a track on the crown of Fulton street between Front and William, and Jacob Sharp, President of the company, had made an oral agreement that the new company should have the right to use this section of track, as it would be unable to lay parallel rails unless the Bleecker Street Company's tracks were removed nearer to the gutter. Under this agreement the tracks of the new company were laid as far as Broadway, exclusive of this strip. When Sharp lost control of the road the direct repudiated his

agreement with the new company, and the construction of the latter has been suspended ever since. The consent of the Bleecker Street Company that the Fulton street road should have the right to use the strip of track in dispute removes an heretofore insurmountable obstacle to the completion of the new road.

Playing the Organ by Electric Motor.

A goodly number of electricians and prominent organists in this city and vicinity, assembled at St. Paul's Church, at the corner of Broadway and Fulton street, on Tuesday afternoon last, upon invitation of the C. & C. Electric Motor Company, to inspect the new arrangement introduced there for blowing the organ. Heretofore the bellows have been blown by hand power, as no machine was available or known that could keep the even pressure of air required to afford smooth organ playing. This has at last been successfully overcome by the employment of the electric motor, which has effected a revolution in so many other fields. The little machine known as the C. & C. electric motor was connected by a belt with a pulley and crank attached to the bellows, and kept them at full pressure at all times. The organist had full control of the motor, and could stop and start at it by pressing a button placed beside the keyboard. The well-known organist, Mr. George Morgan with every one of the thirty-six stops and three manuals in action, failed to "wind" the bellows in the least. The little machine occupies a space of only one foot square at the rear of the organ, and runs perfectly noiselessly. All the organists present expressed themselves as well pleased with the arrangement, and we shall probably soon hear of other organs in the city blown in the same way. With the bellows blown by electricity, and the valve-actions already in many cases operated by electric contacts under the keys, the organist of the future will have little work to do.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
178 Devonshire Street, Boston, Oct. 29, 1888.

New Electric Light Enterprise.

The Chelsea (Mass.) Gas Light Company has obtained authority to furnish electric lights to its customers.

Electric Lights for Medford.

The selectmen of Medford, Mass., have voted to close a contract with the Malden Electric Light Company for 20 arc lights and 200 incandescent lights.

More Electric Lights for Woburn, Mass.

The Woburn Electric Company has bought a large tract of land near to the centre of the city, and will erect a new brick station with capacity of 500 h. p. at once; it is expected that the apparatus will be in the new station by Dec. 1.

A Misleading Rumor.

It has been reported that Mr. A. L. Russell, the well-known manufacturer of telegraph and scientific instruments, contemplated moving his offices and factory from 109 Court street, Boston, to another section of Boston or elsewhere. Mr. Russell informs me that he will remain at the old quarters.

Long-Distance Telephony.

The long-distance service of the New England Telephone and Telegraph Company has been extended to Manchester, Lawrence, Lowell and Nashua. This will now give excellent communication between Boston and Concord, N. H., and all points north and west, including Portland, Me., and Buffalo, N. Y.

Society of Arts.

A meeting of the Society of Arts was held at the Institute of Technology Thursday evening, Oct. 25. Mr. Charles A. White, of Boston, exhibited and described a new form of electric watchman's clock, in which permanent magnets are used instead of the usual chemical batteries; after which Mr. W. E. Gump, of New York, explained the "writing telegraph."

A Busy Concern.

Messrs. John Post, Jr., & Co., of Boston, report having their hands full of new orders for the installation of steam plants for electric light companies, including the New Britain, Conn., Electric Light Company; Eastport, Me., Electric Light Company; Plympton Manufacturing Company, Hartford, Conn., and the factory of A. P. Olzendaws, Manchester, N. H.

Edison Lights.

Messrs. Paine & Francis, New England agents of the Edison United Manufacturing Company, have begun the installation of a 500-light incandescent plant at the station of the Marlborough Schuyler Electric Light Company, at Marlborough, Mass. The New England Wiring and Construction Company, of Boston, has charge of the wiring and other work connected with this installation.

Sawyer-Man Installations.

At the New England offices of the Sawyer-Man Electric Company, at 33 Federal street, Boston, I obtained report of the company's recent installations, as follows: 50 lights at the mills of Henry Adams, at Rockville, Conn.; 400 lights at the Hathaway building, Boston; 100 lights at the factory of the Hockanum Company, Rockville, Conn.; 230 lights at the mills of the Nonantum Worsted Company, at Newton, Mass.; and 300 incandescent (compensating system) lights at the station of the Burling Falls (N. H.) Electric Light Company.

New Telephone Company.

The newly organized acoustic telephone company, known as the National Telephone Manufacturing Company of Boston, has had its first directors' meeting and elected its president and treasurer. Mr. Woodward Emery is president, Mr. S. K. Roberts treasurer, and Mr. J. W. Bennett general manager.

Large and nicely-located offices in the new Hathaway building, on Atlantic avenue, have been already selected by Manager Bennett, and before Nov. 10 the company will be settled in its handsome quarters and prepared to transact business.

Boston Electric Club.

On Wednesday evening, Oct. 24, the rooms of the above named club were filled by a large number of the members and their friends. Mr. T. W. Sprague, Boston correspondent of *The Electrical Review*, delivered a very interesting address upon "Electrical Application to the Mining Industry." The speaker mentioned several instances of economic application of electric power in mines, notably those of the Big Bend, Cal., and Aspen, Col. The address was followed by a discussion of the subject, which developed many interesting facts, and was participated in by Messrs. Rice, Woodbury, Robert, Griggs, Wilson, Webber and others.

Another Electric Motor.

Advices from Portland, Me., report the incorporation in that city of the Robinson-Foster Electric Railway and Motor Company. Mr. Thomas N. Covell is said to be the president. It is stated that the company will locate in Boston and intend to manufacture an electric motor of peculiar merit which will be constructed for street railway purposes exclusively.

Personals.

Among the prominent electrical visitors in this city this week were: Messrs. George Westinghouse, Jr., H. M. Byllesby and C. H. Barney, of the Westinghouse and Sawyer-Man Electric companies; Dr. Otto A. Moses, Mr. J. W. Godfrey, of the N. Y. Insulated Wire Company, and Mr. Geo. F. Calkin, agent of the Brush Electric Company at St. John, N. B.

Mr. Wm. D. McQuesten, of New York, contractor for the Sprague Electric Railway and Motor Company's installation for the West End Railway Company, on Beacon street, Boston, is rapidly pushing toward completion the conduits, poling and wiring work for the new electric road.

Whitman, Mass., to have Electrics.

A dispatch from the above town to the Boston *Herald*, under date of Oct. 25, reads as follows: "There was a largely attended town meeting in Village Hall to-night, to take action upon a system of electric light for the town and other matters. Benjamin F. Peterson was moderator. A report was rendered by Horace Reed chairman of the street lighting committee, and which was favorable to the adoption of the system. Speeches were made by Horace Reed, D. B. Gurney and Benjamin F. Hastings. It was unanimously voted to authorize the street lighting committee to close a three-years' contract with the Whitman Electric Light Company. The company comprise a large number of business men, and work upon a new plant will be commenced at once."

A Wedding at Mr. Ridlon's.

The residence of Mr. and Mrs. Frank Ridlon, No. 48 Lawrence avenue, Dorchester, was the scene of a pleasant wedding last week, the contracting parties being Mrs. Adelaide P. Snethen and Erastus Wheeler Marston, of Oakland, Cal. The ceremony was performed by Rev. Dr. Duryea. The bride wore a rich costume of heliotrope satin and diamond ornaments. The ushers were George S. Page, L. S. Davis and Theodore L. Page, of Washington. After the ceremony a reception was held in the parlor, which was attended by many prominent people. Among those present were His Honor Mayor O'Brien, Miss O'Brien, Miss Belle Ridlon, H. G. Dinsmore, of Cal.; Miss Mary Barnes, Miss Hannah Train, Mr. and Mrs. Pierce, Misses De Bacon, Mr. and Mrs. J. W. Parker, Mr. and Mrs. Franklin Dexter, Miss E. B. Wadsworth, Miss Abbie Hayes, Mr. Frank Cheney, Mr. and Mrs. J. W. McKoren, Miss McKoren, Mr. and Mrs. Chas. T. Holden, Mr. and Mrs. Wm. Gibbs, and Mr. and Mrs. David Gurney. The grounds were brilliantly illuminated with incandescent lights by H. C. Wirt, using the Electrical Accumulator Company's system.

Iron and Steel Electroplating.

The U. S. Plating Company has been organized here to do a general electro-plating business, but particularly to work its specialty of steel plating and copper facing of type. The process of steel facing or plating is an electro process similar to nickel, silver or other kinds of plating. It is applicable particularly to engraved or etched copper plates and electrotypes. Copper plates thus plated are given a hard wearing surface which enables them to withstand the great pressure brought to bear upon them in the process of "plate printing," and also the constant hand-buffing which they have to undergo. The face is put on so that the original print is not disturbed. A delicate plate, faced, can be used for from 2 to 5,000 impressions without the steel being worn through, and when it does begin to show signs of wear the steel plate can be stripped from the copper and a new one applied without the slightest injury to the plate. A copper plate will thus outwear a solid steel plate and give as good results as when new, if kept properly faced. When applied to electrotypes it increases their durability and preserves the sharpness of the lines; 750,000 impressions have been taken from electrotypes (letter press) treated by this process. An especial advantage is that the steel face is absolutely unaffected by the use of colored inks, which is so very damaging to the ordinary electrotype. In addition the cost is very slight. The works of the company are located at 119 Water street, this city, and are fully equipped with every facility for doing a large amount of business very expeditiously. Mr. H. R. Thompson is president. W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 South Tenth Street, Philadelphia, Pa., Oct. 27, 1888.

The Microphone Carbon Battery.

The Cleverly Electrical Works, who have the agency for the microphone carbon battery, report a large number of sales. The claim that this battery is stronger and of longer life than any other sal ammoniac battery made is said to be borne out in practical use, and its neatness is another strong feature in its favor.

The Electrical Society.

The Philadelphia Electrical Society gave the third of its monthly assemblies on Thursday night last week, and it was the most successful yet held. About two hundred guests were present, including nearly all those prominent in the electrical field, and a number of prominent citizens. The popularity of these assemblies increases with each succeeding month, and they also become more and more enjoyable. The rooms of the society are well adapted to the purpose.

A Big Isolated Plant.

The Jackson-Sharpe Company, of Wilmington, Del., have closed a contract for a 135 h. p. Ball automatic engine which will drive 40 Brush arcs and 900 Edison incandescent lamps of 16 c. p. each, to be used in lighting the Delaware Car and Ship Works. Mullen & Pierson, also of Wilmington, have purchased a 100 h. p. Ball, which they will use in running their large morocco works, and an incandescent plant.

The Franklin Institute.

A meeting of the Franklin Institute was held last Wednesday evening to consider the financial condition of the Institute, which in view of the fact that the expenses are greater than the income can hardly be said to be satisfactory. A resolution urging members to bring in new members so as to increase the revenues was left pending. The question of a new building was discussed at considerable length, but no action was reached on it. The idea is to sell the present structure, which is valued at $75,000, and erect a new building in a more central locality.

Some New Magneto Bells.

The Viaduct Manufacturing Company, of Baltimore, Md., have during the past three months been making up a large line of magneto bells, hand generators and extension bells of a new style, which they call the "Monumental," and they are now prepared to fill orders promptly. This is a new departure on their part, and is done in order to supply the demand on the part of the public for a magneto bell which is cheap but at the same time durable and effective. The Viaduct Manufacturing Company feel that they have met this demand by offering the above line of goods at low prices. The trade-mark on the bells will be "Monumental," stamped in crescent form, and the mark has been secured by letters patent. They are able to turn these bells out without interfering with their celebrated standard and pony magnets. These goods are intended for signal purposes in factories, warehouses, stables and public or private houses, for short or long distances, and will supersede battery bells, which at best are expensive and troublesome, but heretofore unavoidable, owing to the excessive cost of magneto bells. They are furnished in a handsome box same size as the "Standard" and "Pony," warranted to ring through 1,500 ohms resistance. The important electrical and mechanical construction is equal to the standard goods, but by cheapening some unimportant parts, and manufacturing them in very large quantities, they are enabled to offer them to the trade at very low prices.

E. W. E.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, Oct. 27, 1888.

Boulder, Col.

The Boulder Electric Light Company have ordered an increase of 400 incandescent lights of the Thomson-Houston system.

Great Falls, Montana.

The A. Eilers' Montana Smelting Company are putting in 24 arc lights of the Thomson-Houston system.

Merchants' Arc Light and Power Company.

The Merchants' Arc Light and Power Company, which was recently organized, is putting in a plant of 80 arc lights, the Sperry system, to be run by a 125 h. p. Taylor engine.

The Electrical Supply Company.

The Electrical Supply Company have just secured the sole agency of the Wright Armature Protector. The company have just completed their stock of test instruments, which they make a specialty of.

Grinnell, Iowa.

The Grinnell Electric Light Company have purchased from the Western Department of the Ft. Wayne Jenney Company 600 incandescent lights of the alternating system. The wire, I may say, used in this installation will be the P. & B.

The Ft. Wayne Jenney Company.

Through the Chicago branch of the Ft. Wayne Jenney Company, W. J. Buckley, manager, Swift & Co. have placed an order for 1,000 sixteen candle-power lights of the alternating system for increasing their Chicago plant. The same company have also ordered for their Omaha plant 600 lights of that system.

Davenport, Iowa.

The Davenport Central Railway Company are supplying quite a number of incandescent lights from stationary power circuits. The capacity of their station it is thought will be severely taxed before the year is out. The economy of operating an electric station of this kind will be readily understood when it is considered that they supply light, stationary power and operate the railway from the one power house.

Telephone Quotations.

Col. S. G. Lynch, broker, 146 La Salle street, furnishes quotations upon telephone stock as follows:

Bell of Mo.	$150@	$155	Iowa Union	$28@	$29
Central Union	47@	48	Michigan	81@	82
Chicago	340@	345	Missouri and Kansas	70@	71
Colorado	43@	46	Rocky Mountain Bell	41@	43
Cumberland	68@	70	Wisconsin	116@	118
Great Southern	34@	37			

Electric Power Prices.

To the article which you published on this subject last week, I would like to add the scale of prices charged for power at St. Paul, Minn., for ten hours service:

H. P.	Per month.	H. P.	Per month.
⅛	$2.00	2	$17.00
¼	3.00	3	25.00
½	5.00	4	34.00
¾	8.00	5	42.00
1	9.00		

Elevator service 10 per cent. off; 5 per cent. discount on bills paid before the 10th of the month.

Lighting by Storage Batteries.

Dr. A. V. Shaw has secured the Western agency of the Gibson Electric Company, manufacturers of storage batteries. He has recently sold a plant for house lighting purposes at Portland, Oregon. The batteries are charged during the day, the power for generating the current being furnished by a Tuerk water motor. He is also putting in batteries to be used for lighting the Freeman Oyster House at Chicago.

Lafayette, Ind.

The Lafayette Street Railway Company have recently placed upon their stationary power circuit one 2 h. p. and one 5 h. p. motor. They have now under contemplation the supplying of 45 h. p. to a flour mill. The Sprague Electric Equipment Company, Chicago, are now building two extensions for the same company. A new overhead switch has recently been invented by one of the

engineers of this company and placed upon the Lafayette Electric Street Railway Company's overhead line, working with perfect satisfaction to all concerned, getting rid, it is claimed, of the trouble from the jumping off of the trolley wheel at switches and turn-outs. Mr. J. Marshall Atkinson is the inventor of the switch.

Hard Rubber Goods for Electrical Purposes.

Chicago has a manufacturer of hard rubber goods. It is Mr. M. C. Chase, 84 Market street, who makes a specialty of hard rubber goods, making to order hard rubber battery cells, and doing other kinds of electrical work. I was recently shown through the factory and had the different processes of manufacturing explained to me. He claims to build the best battery cell in the market for withstanding the action of the different acids.

A Patent Decision.

I am in receipt of an opinion handed down from the U. S. Circuit Court in the case of the Butz Thermo-Electric Regulator Company, of Minneapolis, *vs.* the Jacobs Electric Company, of Milwaukee, in favor of the former. The litigation involves what is known as the Bradford patent No. 222,234, and in the decision rendered the court holds that this patent was a foundation patent, and was, therefore, entitled to liberal construction. This patent, together with other valuable ones, will henceforth be controlled by the Consolidated Temperature Controlling Company, of Minneapolis, Minn., which recently absorbed the Butz Thermo-Electric Regulator Company and control the patents of A. M. Butz. The officers of the company comprise some of the most substantial and prominent men of Minneapolis, and are as follows: C. M. Palmer, president; A. B. Robbins, vice-president: T. D. Merwin, secretary; A. C. Paul, treasurer.

The Telephone Ordinance.

At the meeting of the council Monday night of this week, the following resolution was introduced and passed: *Whereas*, It is currently reported that some person has obtained money or promises of money in the event of the passage by this Council of an ordinance reducing the annual rental of telephones to $75 per annum; and

Whereas, The raising of such funds can only be for the procurement of legislation by corrupt methods, or is a false pretense of those procuring such money or promise: be it therefore

Resolved, That the Law Department is hereby instructed to investigate this matter, and if any person or persons are found to have violated the law either as giver or receiver of such money or promises they shall be prosecuted to the full extent of the law.

Alderman Ernst said that there were a number of "shyster" attorneys and one or two cent. per cent. sharks trying to make money in the way referred to in the above resolution.

Incandescent Lamps on Arc Circuits.

From Mr. C. F. Dunderdale, the representative of the Waterhouse system here, I learn that the series incandescent lamps of his system on arc circuits used in lighting the offices and laboratory of the works of the Joliet Steel Company burn in a very steady and satisfactory manner. It has been maintained all along by many electric light people that it was not practical to burn series incandescent lamps on arc circuits at the same time that arc lights were being burned, and get a steady light. He claims that the prompt and perfect action of the regulator used overcomes the obstacles heretofore met with and says the steel company are well pleased with the results obtained. Mr. Dunderdale also states that his company guarantee their armatures against being burned out from any short circuiting or any inherent defect in the principle or construction of the machine, and that they will submit their armatures and the whole apparatus to any number of tests with the apparatus of any other system.

The Sperry Electric Company.

Last week, in company with Manager Perry, your correspondent was given an opportunity to inspect the factory of the Sperry Electric Company. This company, who were recently reorganized, are rapidly getting into shape to turn out their new apparatus. They have already a large number of orders on hand and the present capacity of the factory is taxed to its maximum. During the past month the company have, among other orders, sold Warren Springer 40 arc lights and the Merchants' Arc Light and Power Company, of this city, 80 arc lights, the apparatus for which is now being made. I saw in operation a 20-light machine, to which was attached the company's new regulator, the invention of Elmer A. Sperry, the electrician. It is a decided improvement on the one formerly used. The device, which is automatic in its working, involves some new principles, and the company are sanguine it will meet every requirement. By its use it is claimed to effect a great saving in fuel. I learn that a large number of electric light men have been in to see the device operate in the cutting in and out of lights, and have expressed themselves as highly pleased.

Nashville, Tenn.

A correspondent at Nashville writes me: Electrical matters are looking up here. The Electric Time Company are doing a good business, and under the management of Mr. G. Davis, who rebuilt all their circuits and got everything in good order, the time is about as reliable as Old Sol himself. The electric light company have added thirteen new street lights since January 1, 1888. Seven all night lights are to be started and run by the West Nashville dummy line, so that our city is quite well lighted. The bridge over the Cumberland River is lit up by incandescent lamps of 20 c. p., and is much better lighted than it was by gas. The business of the company—the Nashville Light and Power Company—has grown so rapidly that they find it necessary to lease adjoining ground for more boiler room. They will put in at once a 150 h. p. compound engine and two 75 h. p. boilers, another 650-light Westinghouse incandescent machine and two No. 7 Brush arc machines, altogether about $30,000 worth of improvements. Electric street railways have come up for discussion, but nothing has yet been done. A local electrician has applied for patents on a new system of making records by electricity. Knowing ones say that it will be second to none of the old style recorders. The system is in use in the office of the lighting company, making a record of the steam pressure day and night with ink that will not fade or rub out. It has also been applied to making a record of the ampère hours of a 20-light converter of the Westinghouse system, showing by the rise and fall of the inked line just when the lights were out and in.

E. L. P.

CANADIAN NOTES.

MONTREAL, Oct. 25, 1888.

The Federal Telephone Plant.

The Federal Telephone Company have nearly all their poles up, and are now stringing cable. Progress is slow, however. If they are ready in the spring, as is now promised, much will have to be accomplished in a short time.

An Accident to Mr. Sise.

I have learned with great regret of an accident to Mr. Sise while driving at Halifax with Mr. Stockton. The evening was quite dark. A farmer driving that way ran into the carriage, throwing Mr. Sise to the ground. Mr. Stockton was also thrown out and injured. He fell upon Mr. Sise, who broke a rib. Mr. Sise is now at home and progressing nicely.

Personals.

Mr. T. D. Lockwood was in town a few days ago on a semi-vacation (he never takes a real one) and a trip through Quebec.

Geo. Cleanson and Henry D. Stanley were also with us one day last week.

Mr. W. R. Kimball, of the Royal Electric Company, began recently a series of lectures before the Y. M. C. A. class. He is a talented young man, and those who have the opportunity of attending will be amply repaid, as he intends illustrating his lectures by experiment.

Electric Lighting.

Electrical matters are very active in Canada, more so, I am told, than has ever been the case before. Electric lighting especially has taken a forward move astonishing to all. Both the Edison and the Royal companies report very brisk business. Among the recent installations by the Edison Company are R. Gardner & Sons, Montreal, 75 lights, and Chatham, N. B., 200 20 c. p. municipal lamps. Thompson's Shoe Factory, Montreal, are running a 200 light plant for their own use and to supply those around them. The James Crossen Car Works, Coburn, are running 300 lights. The town of Valleyfield, Que., has made an increase of 300 lights, and the Maritime Pulp Works, Chatham, N. B., have put in 375 lights. They also report the sale of a plant to the Royal City Planing Mill, Vancouver, and an increase of fifty 50 c. p. lamps by the Vancouver Illuminating Company.

The Royal Electric Company report 12 arcs and 600 incandescent lights to be placed in the new Canadian Pacific station and offices. The dynamo room is to be a special building, separate from the main one. They also report 250 sold at Granby, 30 arcs at Joliet, and 700 incandescents in the town. They have put in at St. Johns, Que., 30 arcs and 500 incandescents. They have sold 50 incandescents at Orangeville and 30 arcs to the Toronto Electric Light Company.

Mr. M. D. Barr has succeeded Mr. Lawson as Canadian Agent of the Edison Company. Mr. Lawson remains and assumes the superintendency of the works at Sherbrooke, Que.

The Royal Electric Company are pushing the foundations for a steam plant of an ultimate capacity of 1,000 h. p. They are to install an incandescent alternating plant of 1,000 lamps, to be in the future increased to 3,000 lamps.

The suit of the Edison Company *vs.* the Royal Electric Company and others was postponed at the request of the Edison Company, who are to bring up an answer on the 10th of November. The suit is for an infringement of the Edison Company's patents in importing the Sawyer-Man lamp.

The city authorities have been considering the advisability of placing a plant large enough to light the city. The matter was referred to City Electrician Badger, who has made his report, recommending two stations of a total present capacity of 800 arcs and 500 incandescent lamps, 32 c. p. The cost is placed for steam and electric plant, including ground and buildings, at $280,000.

MT. ROYAL.

ENGLISH NOTES.

LONDON, Oct. 17, 1888.

Biography of the Late Sir William Siemens.

I understand that a biography of the late Sir William Siemens, which has been prepared Dr. William Pole, F. R. S., who was a personal friend of Sir William and his family, will shortly be published by Messrs. Murray, of London and Edinburgh. This will be followed by several volumes containing reprints of Sir William's most important scientific papers, lectures and addresses edited by his secretary, Mr. E. F. Bamber.

Electric Lighting in the City.

Messrs. Crompton & Co. are credited with the intention of starting a small central lighting station in the heart of the city. I hear that a site has been obtained closely adjacent to the Stock Exchange, and that a large number of orders have already been secured. The charge will be by meter, at 8d. per Board of Trade unit, and the installation will be run on the "battery, transformer" system, which has been so successfully carried out by Messrs. Crompton & Co. at Kensington Court,

Electric Launches on the Thames.

An electric launch has just been built at Chiswick for Messrs. Immisch & Co., which will be named the "Viscountess Bury." This boat is 65½ feet long, with 10 foot beam and a mean draft of 22 inches. She is designed to carry no less than 80 passengers, and is, therefore, by far the largest electric launch which has yet been built, in this country at any rate. The motive power is supplied by 200 E. P. S. accumulators and two Immisch motors of 7½ h. p., which are coupled direct to a pair of three-bladed propellers of Thorneycroft design. I understand that the same firm have given orders for five similar boats, which are being built further up the river.

The Australian Cables.

Last week one of the Eastern Telegraph Company's cable ships, while engaged in repairing the Port Darwin cable, accidentally broke the duplicate cable, which at this point lies far too close to the other. Traffic was suspended for three days, but communication is now restored. The half-yearly meeting of the Eastern Extension Company happened to be held upon the very day when the interruption was announced, and Sir John Pender informed the shareholders that it had already been decided to lay a third cable between Java and Australia. So that in spite of the volcanic nature of the ocean bed upon which these cables are laid, the Australians may now reasonably expect immunity from the total interruptions of their communications with Europe, which have of late been so unfortunately frequent.

The Electric Light for Fishing Purposes.

Amongst the fishing community considerable interest has recently been awakened in the employment of the glow-lamp during night fishing for attracting herrings and other fish to the nets, and, it is stated, although I know not on what authority, that on the Welsh coast a considerable number of fishermen are making regular use of the device, the current being furnished by means of accumulators. In some experiments recently conducted in the presence of several gentlemen interested in the subject, two nets were in the first instance let down to the depth of three fathoms, one with and the other without a lamp. The first, when raised, was found full of fish, but the second was comparatively empty. Similar trials were made at depths of four and six fathoms, with the same result. In another experiment, both nets were furnished with lamps, but one was sent to a depth of five fathoms, while the other was kept on the surface; each contained a large quantity of fish, but those in the five fathoms net were of a different description to those in the surface net. There seems to be no room to doubt the efficacy of the method, and it is quite possible that in some of the larger fishing ports a considerable business might be done with the charging of accumulators for this purpose.

The London Chamber of Commerce.

On Monday next a meeting of the "Electrical and Allied Trades Section" of the London Chamber of Commerce is to be held for the purpose of completing the organization, an outline of which I have already reported to you. It will perhaps be remembered that in August last a provisional committee was appointed to determine the lines upon which the scheme should be carried out. The report of this committee, which will be read at the ensuing meeting, contains a recommendation that a working committee consisting of 33 members should be appointed, divided as follows: telegraph companies, 5 members; telephone companies, 3 members; electrical supply companies, 6 members; electrical manufacturers and contractors, 13 members; consulting electrical engineers, 4 members; general, 2 members. The committee propose that the working committee be elected by ballot, and they have also decided to recommend that the section conform in all respects to the general by-laws and regulations of the Chamber, without at the present time availing themselves of the liberty which is accorded to each section to frame a special set of by-laws to govern their own proceedings. I think there can be little doubt that the committee have acted wisely in not attempting to do too much at once. After the thing has been in working order for a little while it will no doubt be easy enough to find out what special measures should be adopted to perfect the organization.

Electricity and Light.

The researches of Dr. Lodge, Hertz, Wiedemann, Bichat and others upon electrical oscillations and the reciprocal influence of electricity and light continue to attract the greatest amount of attention. Most of the experiments are so simple and so beautiful that every one who possesses the usual appliances for studying static electricity will scarcely fail to repeat them. One of the latest results of pure theory, and one which has not yet been directly verified by experiment, is this, that if an insulated body be caused to move toward a source of light with a velocity greater than that of light itself, it will acquire an electric charge. At first sight it does not seem a very easy experiment to attack, as a velocity of more than 185,000 miles per second in not readily attained by every-day mechanical appliances. As a matter of fact, however, Dr. Lindemann, to whom this theorem is due, believes that it affords a complete explanation of the phenomenon known as "striæ," a well recognized feature of the electric discharge in highly rarefied gases. It would be undesirable within the limits of this letter to explain fully the course of reasoning upon which this conclusion is based. I may, however, just say that Dr. Lindemann's theory involves the supposition that the particles of gas are shot with immense velocity from the positive toward the negative electrode. The dark space which surrounds the positive electrode corresponds to a portion of the path in which the velocity of the particles is actually greater than that of light, consequently they become electrified. A portion of their mechanical energy being aborbed by the electrification, their velocity falls, and as soon as it reaches the limit of the rays of higher refrangiblity, it necessarily becomes visible in the form of light. But the particles are now inductively acted upon by the electric charge of the positive electrode, and after passing through a certain minimum velocity they are carried along at an increased rate, once more forming a dark band. In this way the alternation of dark and light bands throughout the tube is supposed to be fully accounted for.

THE TELEGRAPH.

Little Rock, Ark., is to have a fire alarm system.

Baltimore, Md.—The capital stock of the International Telegraph District and Construction Company has been increased from 2,000 to $100,000.

Ticker Fights.—The Commercial Telegram Company's fight to retain its privileges in the Stock Exchange is on again before Judge Andrews in the Supreme Court.

The Cable Convention.—England has given notice of the adhesion of Canada, Newfoundland, Cape Colony, Natal, Australia and New Zealand to the submarine cable convention.

Bismarck's Telegraph Poles—Prince Bismarck gave a fête last month to his servants and tenants at Friedrichsruh to celebrate the dispatch to Berlin of 5,000 telegraph poles, which makes 100,000 which have been supplied to the state during the last ten years from the Chancellor's forest there.

Commercial Cable.—The Commercial Cable Company has decided to increase its capital stock from $6,000,000 to $10,000,000. This company contemplates taking up the outstanding bonds as fast as they mature, and will probably anticipate the maturity of a part of these bonds and replace them with stock. Up to the present time $600,000 have been retired.

An Expert Telegrapher's Death.—A dispatch from Sandusky, O., of Oct. 23, says: Willis J. Cook, the noted telegraph

operator and familiarly known as "Bif," died at the home of his parents here to-day from blood poisoning resulting from malarial fever contracted at Aspinwall, where he was chief operator in the service of the Panama Railway. Mr. Cook was known far and wide as one of the greatest experts of the craft, and several years ago was in the service of the Associated Press at Washington on the New York and Washington circuit. His remarkable feats of telegraphy there made him famous among operators throughout the country. Mr. Cook was in the thirty-seventh year of his age.

A Decision for Western Union.—Chief Justice Fuller delivered his first opinion in the Supreme Court of the United States at Washington, on Oct. 22. The case was that of the Western Union Telegraph Company, plaintiff in error, against the Commonwealth of Pennsylvania, brought up on an appeal from the Supreme Court of Pennsylvania. The Commonwealth levied a tax on all telegrams passing over the company's lines within the State, this tax being imposed regardless of the fact that much of the business was not confined wholly to the State, but was to points in other States. The U. S. Supreme Court held, through Chief Justice Fuller, that the State was not entitled to collect a tax except for messages between points within the borders of the State, and accordingly reversed the judgment of the State Court, with costs, and remanded the case to the lower court for further proceedings.

THE TELEPHONE.

Louisiana.—The levee board of the Fifth Louisiana District, Delta, La., wants materials for a telephone line 200 miles long.

The Columbus Telephone Company, of Covington, Ky., has been formed by J. P. Dietter and others, with a capital stock of $10,000.

Farmington, N. H.—The telephone system at Farmington, N. H., has been discontinued, and the wires will be removed. It has never been a paying investment there, the receipts for September being less than $5.

New England Telephone.—A dividend of 75 cents per share for the September quarter has been declared by the New England Telephone and Telegraph Company. Mr. F. J. Boynton's report as auditor shows gross receipts of $288,862 for the quarter and net earnings of $78,792.

The Pan Electric Suit.—In the District Supreme Court in General Term at Washington, on Oct. 15, in the case of J. Harris Rogers against A. H. Garland, Joseph E. Johnston, and others, the demurrer entered by all of the defendants except Attorney-General Garland was overruled, and the defendants were required to answer. The Chief-Justice referred to the charge that the plaintiff had been refused information as to the condition of the affairs of the company, and was of the opinion that he was entitled to an accounting. Mr. Garland, in his answer under oath, denied the allegations of the bill, and consented to an accounting by the executive committee for all sums realized by Rogers from sales of stock in violation of the agreement. The decision requires that defendant shall now answer.

Bell Telephone.—The Bell Telephone Company's instrument statement for the month ended Oct. 20 makes a favorable exhibit. The net output increased 519, and for 10 months the increase has been 4541 instruments. The comparative figures are:

Month, Oct. 20.	1888.	1887.	Increase.
Gross output	4,140	3,689	451
Returned	2,145	2,213	*68
Net output	1,995	1,476	519
Since Dec. 20.	1887-8.	1886-7.	
Gross output	45,800	44,340	1,460
Returned	18,947	22,028	*3,081
Net output	26,853	22,312	4,541

*Decrease.

THE ELECTRIC LIGHT.

Florence, Ala.—Mr. G. W. Swartz proposes to improve his plant.

Aberdeen, Miss.—The city plant will comprise 25 arcs and 200 or 300 incandescents.

Wilmington, N. C.—The Wilmington Electric Light Company will enlarge their plant.

Statesville, N. C., will spend its $8,000 of bonds on a Brush plant of 30 arcs and 150 incandescents.

Mansfield, O.—The Richland Electric Light and Power Company, of Mansfield, has been incorporated by J. H. Hill and others.

Lancaster, Pa.—The Lancaster Arc Light Company has been formed by H. K. Miller and others with a capital stock of $15,000.

Jacksonville, Fla.—The Jacksonville Electric Light Company despise microbes, and are putting in two new 100 horse-power boilers.

Chicago, Ill.—The Hill Clutch Works of Cleveland have contracted and made designs for an electric light plant for Gore's Hotel, Chicago.

Holton, Kan.—The Holton Electric Light and Power Company has been incorporated by M. B. Smith and others with a capital stock of $20,000.

Paducah, Ky.—The Paducah Gas Light Company have recently enlarged their arc light plant somewhat by adding a number of Brush lamps thereto.

Osage City, Kan.—The Osage City Electric Light Company has been incorporated by by J. B. Marshall and others with a capital stock of $15,000.

The Hill Clutch Works, of Cleveland, have had an order for a number of their friction clutch pulleys from the Pendleton (Ore.) Electric Light and Power Company.

Waco, Tex.—The Central City Electric Light Company has been formed by M. D. Herring, S. Sanger, T. Jones, J. Moore, J. B. Baker and others with a capital stock of $30,000.

Chippewa Falls, Wis.—The demand for electric lights is increasing so rapidly that J. H. Woolsy, of St. Paul, has decided to place two more large dynamos of the United States alternating system there.

Danbury, Conn.—It is reported that subscribers for the lights of the Danbury and Bethel Gas and Electric Light Company are kicking because of a slight increase in the tariff.

Cleveland, O.—A resolution has been passed by the City Council authorizing the Committee on Lighting to advertise for bids for lighting the city during 1889 by the tower, arc or any other electric system.

Cleveland, O.—The American Wire Company, of Cleveland, have recently purchased from the Brush Electric Company, of the same city, a plant having a capacity of 45 1,200 c. p. lights and 75 16 c. p. Swan incandescent lamps.

Philadelphia, Pa.—John Wanamaker, of Philadelphia, has just contracted for a 500 light Brush-Swan plant for the lighting of his country residence. The order was taken by Edward W. Tisdall, the Philadelphia representative of the Brush Electric Company.

New Bedford, Mass.—The New Bedford Gas Light Company have, reports Mr. Wonham, New York agent of the Hill Clutch Works, accepted the designs and plans of the works for the complete equipment of their new station with clutches and everything else necessary in the line of power transmission machinery.

Palmer, Mass.—John S. Holden, the well known woolen manufacturer at Palmer, and president of the Palmer Carpet Company, has been elected president of the Palmer Electric Light Company, of that place. This will insure great strength to the electric company and is a guarantee to patrons of a first class electric service.—*Bost. Jour. Com.*

Fall River, Mass.—The new Mellen House, Fall River, a handsome and first-class hotel, has been formally opened. Its complete equipment includes electric lighting by the Mather Company, steam boilers by the Fall River Machine Company, and engines by the Westinghouse Company. There are three boilers of 80 h. p., a 65 h. p. engine, and 500-light dynamos, for heating and lighting.

Newburgh, N. Y.—The Edison Electric Illuminating Company, of Newburgh, N. Y., has just finished a number of important changes in the arrangement of their electric apparatus, and have laid another feeder from their station to supply the new Academy of Music with incandescents, and open up a new territory to the Edison light. The Newburgh Company is one of the oldest of the Edison organizations.

The Boulton Carbon Case.—Mr. W. H. Boulton has been enjoined by Common Pleas Judge Hamilton, in Cleveland, from conducting his business under the name of the Boulton Carbon Company, or advertising under that name to the effect that he produces the only reliable Boulton carbon. He gave notice of an appeal to the Circuit Court and was given thirty days in which to prepare a bill of exceptions. The appeal bond was fixed at $5,000.

The Edison Electric Light Company have elected the following Board of Trustees for the year 1888-9: T. C. Buck, C. H. Coster, Noah Davis, J. W. Doane, T. A. Edison, A. F. Higgins, E. H. Johnson, M. H. Smith, F. S. Smithers, A. J. Thomas, Spencer Trask, F. R. Upton, J. Hood Wright. The officers are: President, E. H. Johnson; Secretary, F. S. Hastings; Comptroller, J. H. McClement; General Superintendent, J. H. Vail; General Counsel, S. B. Eaton.

Deafness Caused by the Electric Light.—A curious phenomenon was recently related by M. D'Arsonval before the French Academy of Medicine. After gazing for a few seconds on an arc light of intense brilliancy, he suddenly become deaf and remained so for nearly an hour and a half. Surprised and somewhat alarmed in the first instance, but reassured by the disappearance of the symptoms, he repeated the experiment with the same result. When only one eye was exposed to the light no very marked effect was produced.

A Waterhouse Gold Medal.—The Waterhouse Electric and Manufacturing Company, of Hartford, Conn., were awarded a gold medal at the Cincinnati Centennial Exposition, and two silver medals the same covering the arc light plant at the exposition. It is stated that the judges speak in the highest terms of the Waterhouse system of electric lighting. This is the second gold medal awarded to the Waterhouse Company, the first being received from the Mechanics' Fair, Boston, in December last.

Woonsocket, R. I.—The Woonsocket Electric Light Company has at present five engines of 500 h. p. Under a full head of water the water-wheel has 250 h. p. There are three 2,000 c. p. arc dynamos in daily service to run the street lights, and one in reserve. In addition to the street light dynamos there are three 1,200 c. p. arc dynamos to run the arc store lights, and five 400-light incandescent dynamos. The company has in service 79 street lights, the town paying for 77, the company maintaining two at their own expense, one on the top of their office and one on the Bernon street bridge. There are 79 commercial lights in use and 1,500 incandescent. Of electric motors there are 21, ranging from one-eighth to fifteen horse-power. In addition to these there are twelve series lights on arc circuits, each of 65 c. p. —*Woonsocket Patriot.*

The Ball System.—Among their late sales the Ball Electric Light Company, of New York City, report the following: Standard Light and Power Company, Montpelier, Vt., 25 arc lights; Wamsutta Mills, New Bedford, Mass., 70 arc lights; St. Louis Electric Power Company, St. Louis, Mo., 50 arc lights; Jaime F. Carillo, Maracaibo, Venezuela, S. A., 95 arc lights, American Electric Light Company, Kansas City, Mo., 75 arc lights; C. D. Wright, Petersburg, Ill., 50 arc lights; Adam Glass, Mobile, Ala., 25 arc lights; Wilmington City Electric Company, Wilmington, Del., 25 arc lights (increase); Walworth Steam and Power Company, Boston, Mass., 70 arc lights; California Street Cable Railway Company, San Francisco, Cal., 100 incandescents; St. Clair Mineral Springs Company, St. Clair, Mich., 500 incandescents; Chrome Steel Co., Brooklyn, N. Y., 10 arc lights.

Medford, Mass.—The question of electric lighting at Medford came up before the board of selectmen on Oct. 23. W. P. Martin said that the Medford company could do nothing without having another meeting, and as the selectmen do not propose to wait any longer, and as the Malden company had signified its readiness to present a contract and carry it out at once, the board went into executive session to consider the terms. By a unanimous vote, a contract was closed with the Malden Electric Light Company for 200 incandescent lights and 20 arc lights, the latter and 40 of the incandescent lights to be furnished immediately, and the balance of the 200 incandescent lights to be furnished before spring. All the other lighting in town is to be by oil lamps furnished by the same company, and the whole system of lighting to be furnished at the rate of $7,000 per year for a term of three years.

Electric Lights in Ice.—The Cincinnati *Times-Star* of Oct. 20 says: Talk about something new under the sun. There was something done at the Centennial yesterday that has never been attempted before, let alone accomplished. For it was something that was declared impossible on the face of it. Think of an incandescent light, frozen in ice and burning. This feat was accomplished by F. P. Adams, of the Jenney Electric Company, of Indianapolis. The ice was frozen by the Cincinnati Ice Company. While the process of freezing was proceeding various colored aniline dyes were put in and the most beautiful effects in color and formations produced, and then there was the glass bulb, that we are all so familiar with, with its filmy trace of wire, upon which the electric current flashed and glowed at the will of the operator. Of course, some heat is generated by the light, and, to think of freezing it in a solid chunk of ice and not cracking the glass and the electric light burning successfully, seems more like a miracle than a human accomplishment. It attracted thousands.

APPLICATIONS OF POWER.

South Orange, N. J., is to have an electric road on the Daft system. It will have overhead wires.

The Robinson-Foster Motor.—The Robinson-Foster Electric Railway Motor Company, of Portland, Me., has been formed by T. N. Covell and others, with, it is said, a capital stock of $10,000,000.

The Enos System.—The Enos Electric Street Railway Company has levied an assessment of 25 cents per share, 10 cents being payable Oct. 5, and the balance of 15 cents, if found necessary, will be payable Dec. 1.

The Pumpelly Storage Battery.—An incorporation has been formed at Chicago by J. K. Pumpelly, L. Mendelsohn and A. Crossman, called the Pumpelly Storage Battery and Motor Company, with a capital stock of $300,000.

Seattle, W. T.—Articles of incorporation of the Seattle Electric Railway and Power Company, with Frank H. Osgood, Edward C. Kilbourne, Thomas Burke, L. H. Griffith, G. M. Haller, Angus Mackintosh and Victor H. Smith as incorporators and trustees, have been filed. This is the consummation of the consolidation of the Seattle Street Railway Company and Dr. Kilbourne's electric motor company. In the near future electricity will be substituted for horses as a motive power on the lines now owned and operated by the Seattle Street Railway Company, and the road for which Dr. Kilbourne's company has a franchise will be built. The capital stock is $120,000, divided into $100 shares. The principal place of business is Seattle, and the term fixed for the duration of the company is 50 years.

PERSONALS.

Mr. R. B. Adams, Jr., of the editorial staff of the *Railroad Gazette*, contributes to the November *Scribner* an excellent article on "The Every-Day Life of Railroad Men." With graceful and sympathetic touch, the hardships and burdens of the engineer, brakeman, conductor, station agent, baggage master, and others are portrayed, and one's feelings of admiration are aroused at the way in which these employés do their daily duty. Mr. Adams writes out of his full acquaintance with all the details of railroad work, including telegraphy, and has performed a difficult task with exceptional skill and success.

Mr. C. H. Avery.—The Rochester *Democrat* of Oct. 23 has the following: The marriage of Miss Minnie Metcalf to Charles H. Avery, of Geneva, occurred at the home of the bride's parents in Varick, Wednesday evening. The contracting parties are both well known in Geneva. The groom has been superintendent of the Brush-Swan Electric Light Company there since its organization, and is a very popular young man. They are the recipients of many very handsome presents from the Brush Electric Company and employés and numerous friends. The ceremony was performed by the Rev. R. E. Salisbury of North Coshocton, N. Y.

Mr. T. D. Lockwood is the subject of a very interesting biographical sketch in the *Journal*, of Melrose, Mass., of which place he is a resident. It appears that Mr. Lockwood was born in Birmingham, England, on December 20, 1848, and crossed the Atlantic in 1865. The first evidence of his great ability as a technical writer was given in 1869 in an article for the *Scientific American* on the manufacture of polished plate glass. The details of Mr. Lockwood's busy and honorable career, as an electrician, telephonist, electrical expert, litterateur and lecturer show that he has earned his present distinguished position by the downright hard work that has been so well defined as genius.

MISCELLANEOUS NOTES.

The Western Electric Lock Company, of Kansas City, Mo., has been formed by B. F. Jones and others with a capital stock of $100,000.

Electric Fruit.—"George, dear, what kind of fruit is borne by an electric light plant?" "Electric currents, of course."—*Terre Haute Express.*

The Cutting Electric Alarm Company, of East St. Louis, Ill., has been formed by W. H. Cutting and others, with a capital stock of $8,000.

The Ohio Valley Electrical Company, of Cincinnati, has been incorporated by J. G. Schmidloff and others with a capital stock of $50,000.

Electric Supply.—The New York Water and Electric Sup-

ply Company, of Buffalo, N. Y., has been formed by R. Palen and others, with a capital stock of $15,000.

The New England Phonograph Company, of Gardiner, Me., has been formed by J. B. Gleason and others, of New York city, with a capital stock of $2,000,000.

Death Penalty for Dogs.—It has been decided not to use the alternating current in this city for killing dogs. Nothing definite in substitution for drowning has yet been decided upon.

The Graphophone at Work.—The first graphophone, or improved phonograph, to be practically applied to office work in this city has been set up in the law office of Lowery, Stone & Auerbach, in the Mills Building. The machine was set up in the room devoted to typewriters and stenographers. The lawyers expect to talk a good deal of their correspondence into the funnel of the machine, and their clerks will reproduce the sounds and write out the letters at their leisure.

The Junior Edison Association.—The first meeting of the season of this society was held at No. 65 Fifth avenue, on the evening of Oct. 25, Mr. Wm. H. Meadowcroft presiding, in the absence of the president, Mr. C. J. Field. The subject of the evening was "Dynamo-Electric Machines." Mr. W. A. Mosscrop showed how the various characteristic curves of the dynamo machine are obtained, and the manner in which they are interpreted. Mr. E. T. Birdsall and Mr. Frank Bourne also made some remarks and gave their experience in the operation of dynamos.

Another Drawbaugh Invention.—The following comes from Harrisburg, Pa.: An apparatus has been invented by Daniel Drawbaugh, of Eberley's Mills, to be used for signaling vessels in mid-ocean, and which can be used on vessels to signal one another. Mr. Drawbaugh has worked long and patiently in the pursuit of this new discovery, and experts who have examined it assert that it is a valuable invention and one which will create a revolution in naval affairs. A public exhibition of the apparatus will be made in the Susquehanna River in a few days, on which occasion marine officers and experts will be present.

BUSINESS NOTICES.

Electric Light Primer. Second edition. Revised and enlarged. Treats on Storage Batteries, etc. Science in simple language. Mailed free. Fifty cents. C. L. Levey, 49 Broadway, N. Y.

Jordan & Gottfried, 208 Canal Street, N. Y., carry a complete stock of iron and brass machine and wood screws, bolt, cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

The Partz Electric Battery Company, of Philadelphia, having found their old quarters at 1,723 Chestnut street too small, have leased the large building at 636 Arch street, same city. They are now prepared to fill all orders promptly, and in addition to their large line of Open Circuit and Gravity and Motor Batteries, have a full line of small Motors and Dynamos. Send for their price list and catalogue, or write to them, stating what you want.

The Rogers Patent Sectional Grate is being pushed for electrical plants by the Salamander Grate Bar Company of 110 Liberty street. It is claimed to be unequaled for burning fine and waste fuel. The testimonials presented show it to be free from warping and twisting, while the liberal air space insures a thorough combustion. The Water Commissioners of Asbury Park, N. J., make a very favorable report as to economy of fuel and rapid steaming.

The Jarvis Engineering Company, No. 61 Oliver street, Boston, have just closed contracts with the following concerns to furnish Armington & Sims engines: Wm. Knowlton & Sons, West Upton, Mass., one 50 h. p.; Newton Electric Light and Power Company, Newtonville, Mass., one 100 h. p.; E. & T. Fairbanks, St. Johnsbury, Vt., one 100 h. p.; Consolidated Electric Light Company, Portland, Me., one 90 h. p.; Burlington Gas Company, Burlington, Vt., one 60 h. p.; Hyde Park Electric Light Company, Hyde Park, Mass., one 100 h. p.; Edison Electric Illuminating Company, Boston, Mass., one 135 h. p.; Hotel Vendome, Boston, Mass., one 40 h. p.; New Haven Electric Company, New Haven, Conn., two 90 h. p.; Bridgeport Electric Light Company, Bridgeport, Conn., two 90 h. p.; Boston Electric Light Company, Boston Mass., six 90 h. p.

The Jarvis Engineering Company, No. 61 Oliver Street, Boston, have recently received orders from the following concerns to set their new boilers with the Jarvis patent furnace: A. F. Hessler & Son, Reading, Pa., 1 boiler; N. T. Hill, Portland, Me., 1 boiler; Athol Electric Light Company, Athol, Mass., 1 boiler; Louisville Electric Light Company, Louisville, Ky., 3 boilers; Bath Electric Light and Power Company, Bath, Me., 1 boiler; Blackinton Woolen Company, Blackinton, Mass., 1 boiler; Hyde Park Electric Light Company, Hyde Park, Mass., 1 boiler; Augusta Brewing Company, Augusta, Ga., 2 boilers; Girard Wrench Manufacturing Company, Girard, Pa., 1 boiler; J. D. Thomas, Knowlesville, N. Y., 1 boiler; A. W. Brodie, Hespeler, Ont., 3 boilers; Auburn Electric Light Company, Auburn, N. Y., 2 boilers; Reading Steam Heat & Power Company, Reading, Pa., 4 boilers; Chas. L. Van Reed, Reading, Pa., 4 boilers; Beebe Estate, Boston, 2 boilers.

Hine & Robertson.—When a firm find their goods are meeting with unprecedented success, and orders for their specialties continue unabated, it must be admitted that the goods are meeting all the requirements that they are represented to fulfill. The firm of Hine & Robertson, 45 Cortlandt street, N. Y., makers of the Eureka Packing (guaranteed the finest piston-rod packing made), will send any responsible firm a sample free to pack a box. This firm made a novel and unrestricted offer to take first-class electric light stock in exchange for their noted damper regulator, which is now in use by over 50 electric light plants. They are receiving high encomiums and testimonials in regard to Hine's eliminator for extracting grit, oil and grease from exhaust and water from live steam for high speed engines and electric light plants. This eliminator is unquestionably necessary in every steam plant. One of these eliminators is now in use on the Beck engine running the United States electric light plant at the Fair. The percentage of oil extracted is truly astonishing.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

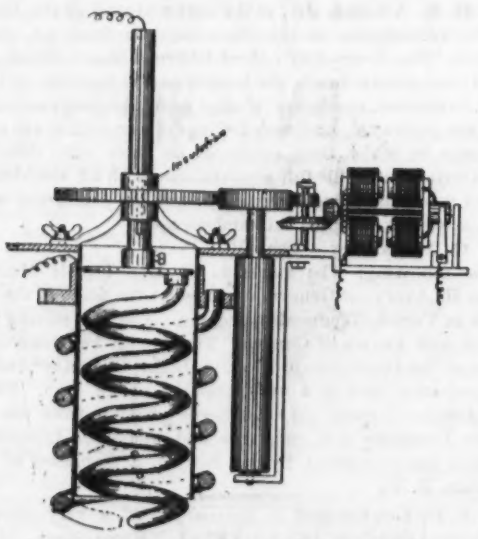
PATENTS DATED OCT. 23, 1888.

391,437. Electrical Potential Differentiator; Elihu Thomson, Lynn, Mass. Application filed Aug. 15, 1888. The object of the invention is to provide a means whereby alternating, pulsating or intermittent currents of any potential may be converted into any one of a large number, or a range of potentials different from that of the original or impressing current, and either greater or less than the same. See illustration.

391,446. Clock Synchronizer; Arthur G. Wiseman, Webster Groves, Mo. Application filed May 24, 1888. The second hand is thrown to any position by the operation of a magnet upon an adjustable rack and pinion.

391,447. Electric Railway; Parvin Wright, Denver, Colo. Aplication filed March 9, 1888. The object of the invention is to improve the construction of the separable contacts and their circuit connections, so as to render them more reliable in operation, and less liable to become impaired by use.

391,468. Automatic Circuit Changer for Secondary Batteries; William W. Griscom, of Haverford College, Pa. Application filed June 30, 1888. A secondary



391,477. ARC LAMP.

battery, a working circuit therefor, a switch or circuit changer for making and breaking said circuit, and an electro-magnet having its coils included in said circuit controlled by a predetermined strength of current to operate said switch or circuit changer.

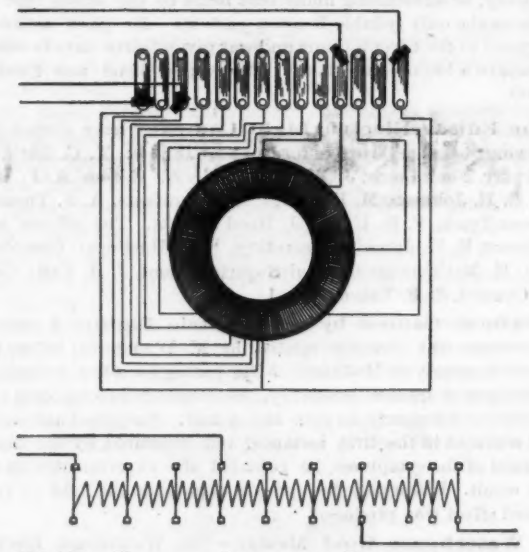
391,477. Arc Lamp; Hosea W. Libbey, Boston, Mass. Application filed Oct. 10, 1887. Spiral carbons, arranged one within the other, with a cylinder of insulating material between them, in combination with mechanism for causing them to rotate in opposite directions, and the inner one at a quicker speed than the outer one, so that the points of contact will always be in the same place. See illustration.

391,505. Galvanic Battery; H. J. Brewer, New York, N. Y. Application filed Nov. 12, 1885. The electro-negative element is provided with pockets to receive additional matter of the same nature, thus increasing the E. M. F. at will.

391,512. Electric Switch; W. B. Cleveland, Cleveland, O. Application filed July 25, 1885. Claim: In an electric switch the combination of a primary actuating device, a movable contact bar, and a spring connected respectively with said two members, said primary actuating device having a range of movement wherein the line of said two spring-connected points may pass respectively to opposite sides of the dead centre line of the spring movement, substantially as described.

391,517. Electric Cable Joint; Joseph E. Cuff, Denver, Col., Assignor of one-half to Moses L. Stern, of same place. Application filed April 12, 1888. A sleeve with openings at the top and bottom, and provided with a trap screw, bulb and suitable gaskets, said sleeve and bulb being filled with insulating compound and inclosing two or more electric cable ends suitably clasped together.

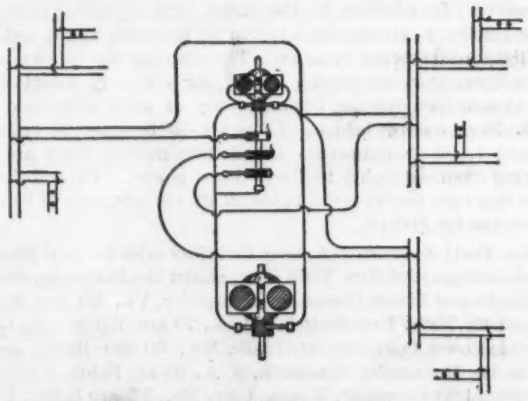
391,547. Electrical Continuity Vibrator; George F. Milliken, of Boston, Mass., Assignor to the Gamewell Auxiliary Fire Alarm Company, of same place. Application filed Dec. 9, 1877. The invention has for its object the utilization of the battery current for additional purposes in a vibratory electrical circuit, and aims to obtain this result by preserving the



391,437. ELECTRIC POTENTIAL DIFFERENTIATOR.

continuity of the circuit, and without the loss consequent upon the opening of the main circuit by a self-acting electro-magnetic vibrator, and also to provide a new form of continuity vibrator.

391,568. Railway Train Indicator; B. E. Waters, Brockton, Assignor of one-half to Moses E. Hatch, of New Bedford, Mass. Application filed April 9, 1888. The invention is embodied in an apparatus comprising a case or frame work containing a number of movable signs each bearing the proper description for a given train, combined with an electro-magnet and its armature for each sign, by which the said signs are normally retained concealed and so arranged that the proper



391,595. SYSTEM OF ELECTRIC LIGHTING.

attendant by closing the circuit of a given magnet may cause a corresponding sign to be displayed and preferably an audible alarm sounded, so as to call attention to the sign that has just been brought to view.

391,587. Conduit for Electric Wires; Madison Dallas, New Orleans, La. Application filed June 11, 1888. The wires are hung in brackets fixed to the curb, and are covered by a ledge.

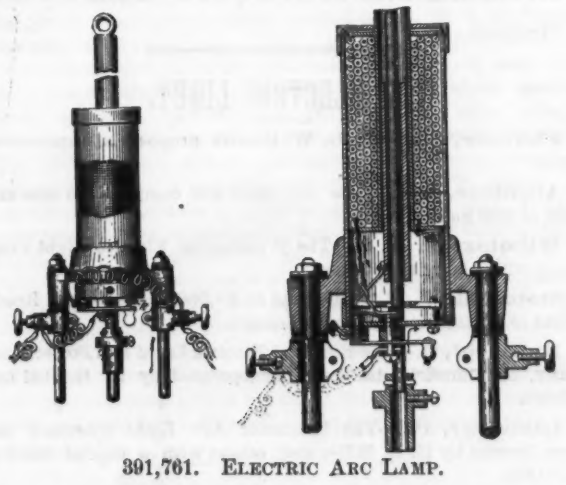
391,590. Electric Motor; John Doyle, Hoboken, N. J., Assignor to himself and C. Coles Dusenbury, Lake Mahopac, N. Y. Application filed Sept. 8, 1887. The cores of the armature bobbins extend into the space bounded by the pole pieces.

391,592. Electric Measuring Instrument; A. H. Eddy, Hartford, Conn. Application filed Dec. 20, 1887. For description see page 243, this issue.

391,593. Automatic Commutator for Alternating Electric Currents; Arthur H. Eddy, Hartford, Conn., Application filed Dec. 20, 1887. The invention consists in a vibrating motor operated by the alternating current and actuating switching devices adapted to switch all the alternations into a succession of impulses in one direction in the motor circuit.

391,594. Arc Extinguisher for Electric Switches or Cut-Outs; Arthur H. Eddy, Hartford, Conn. Application filed Dec. 20, 1887. A circuit opener provided with one or more movable blades of insulating material adapted to movement across the arc-forming line and dependent for operation upon the act of opening the circuit.

(1) 391,595. (2) 391,596. (1) System of Electric Lighting; (2) Incandescent Electric Lamp; Thomas A. Edison, Menlo Park, N. J. Applications filed, respectively, Aug. 7, 1884, and Oct. 2, 1884. (1) Two or more branch circuits each containing a translating device or devices requiring current of a certain tension when constantly in circuit, and a main circuit on which is maintained a current of higher tension than is required by the translating devices, each of said branch circuits being connected with the main circuit through a circuit controller, which rapidly opens and closes the circuit alternately. See illustration. (2) To prevent the arcing of the lamps which frequently occurs on the pumps, the area of the



391,761. ELECTRIC ARC LAMP.

positive metallic terminal within the lamp is enlarged. This enlargement may be detached without destroying the vacuum.

391,605. Cable Hanger; E. J. Hall, Buffalo, N. Y. Application filed Jan. 21, 1888. A cable hanger consisting of two parts, the upper portion being provided with a hook and the lower portion being of wood, the two parts being clasped to the cable and rigidly secured thereto by a tie wire.

391,720. Electric Plaster; Harry P. Pratt, Chicago, Ill., Assignor to the Pratt Electric Therapeutic Company, of same place. Application filed July 5, 1888. An adhesive plaster having upon it an electric generator and one or more electrodes connected with the generator.

391,761. Electric Arc Lamp; Samuel E. Nutting, Chicago, Ill. Application filed Nov. 18, 1887. The invention consists in making an automatic brake or retarder whose effect will maintain a constant relation to the electric current, so as to vary as it varies. With this in use the dash pot may be discarded. See illustration.

391,762. Telephone Exchange System; Charles E. Scribner, Chicago, Ill. Application filed June 6, 1881. The invention consists partly in grouping the subscribers' lines on opposing sides of the wire containing the listening operator's telephone outfit, and thereby dispensing with the ground connection at the central office.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, N. Y.